THE ELECTRICAL WORLD

VOL. IV.—No 21. NEW YORK, NOVEMBER 22, 1884. {$3.00 PER ANNUM. {10 CENTS A COPY.

The American Electrical Exhibition.

On Dec. 1 the American Electrical Exhibition begins at Boston, in the building of the Massachusetts Charitable Mechanic Association, on Huntington avenue and West Newton street. We give on this page a view of the building and a diagram of the interior, and a very favorable impression will be gathered from both. The buildings used in Europe for the electrical exhibitions have been of a costly and ornate character; the building put up at Philadelphia by the Franklin Institute had many meritorious architectural points, and it will be seen that in this respect Boston will easily hold its own, offering for use a handsome and commodious structure. It is to be borne in mind that nearly all preceding electrical exhibitions have had the very valuable elements of beauty in the *tout ensemble*. At Paris the electrical exhibition took place in the stately and beautiful Palais de l'Industrie, and, to use the felicitous remark of a Parisian visitor to Philadelphia, who could not overlook the rough manner in which many of the exhibitors had installed themselves, the objects in Paris were not merely exhibited, they were displayed. In Vienna, the exhibition was well housed and was put together in excellent taste. When it came to the turn of this country to hold an electrical exhibition, the necessities of the case led the Franklin Institute at Philadelphia to erect a new building for the purpose. The risk was heavy for a scientific society to assume, and hence, while the building was made attractive and even beautiful in its main architectural features, little money was devoted to adornment and enrichment in detail. As a whole, too, the displays were more of a utilitarian than an æsthetic nature, and hence many visitors from abroad spoke of the Exhibition as being mainly a striking exemplification of the thorough "practicability" of Americans and of their slight regard for mere externals.

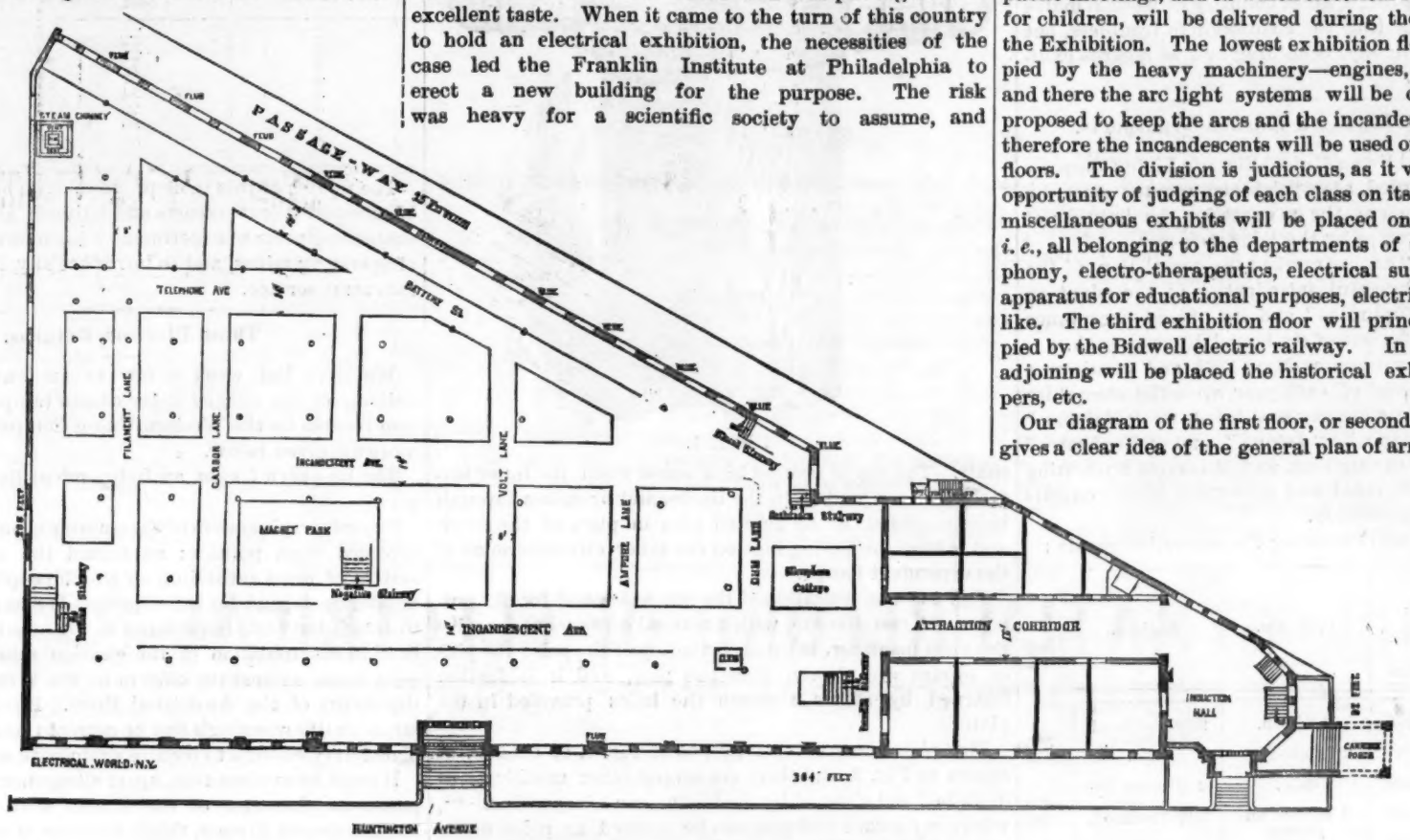
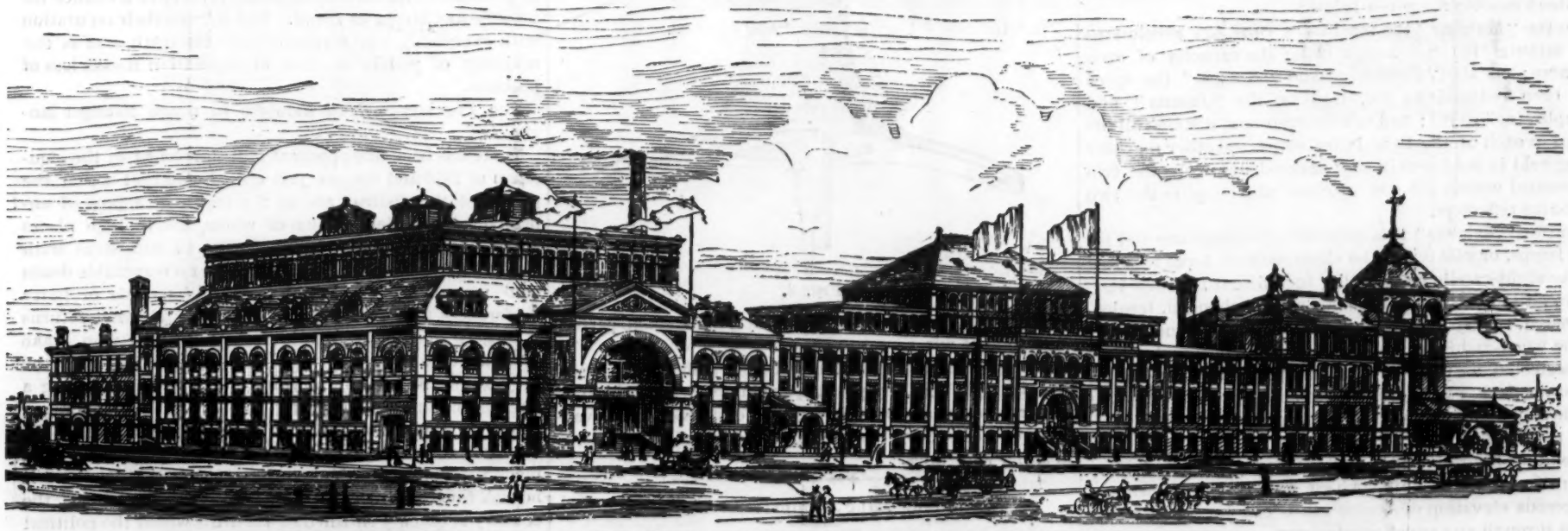


DIAGRAM OF FIRST FLOOR, AMERICAN ELECTRICAL EXHIBITION, BOSTON, MASS.

The available part of the building has in reality three floors, although the first is called a basement. The Electrical Exhibition will occupy these floors from the middle of the picture to the right-hand end, where the entrance is located. The wing at the left hand is an immense hall, for public meetings, and in which electrical lectures, specially for children, will be delivered during the continuance of the Exhibition. The lowest exhibition floor will be occupied by the heavy machinery—engines, dynamos, etc., and there the arc light systems will be displayed. It is proposed to keep the arcs and the incandescents apart, and therefore the incandescents will be used only on the upper floors. The division is judicious, as it will afford a good opportunity of judging of each class on its own merits. The miscellaneous exhibits will be placed on the next floor, *i. e.*, all belonging to the departments of telegraphy, telephony, electro-therapeutics, electrical supplies, electrical apparatus for educational purposes, electrical toys and the like. The third exhibition floor will principally be occupied by the Bidwell electric railway. In the Art Gallery adjoining will be placed the historical exhibit, books, papers, etc.

Our diagram of the first floor, or second exhibition floor, gives a clear idea of the general plan of arrangement there. It will be noticed, too, that electrical names have been applied to the different parts of the floor and the approaches thereto. Thus there is Induction Hall, Attraction Corridor, Microphone Cottage, Magnet Park, Incandescent and Telephone avenues, Volt, Ampère, Ohm, Carbon and Filament lanes and Positive, Negative, Shunt, Resistance and Potential stairways. This is at least more picturesque than lettering or numbering could be.



THE BUILDING OCCUPIED BY THE AMERICAN ELECTRICAL EXHIBITION, BOSTON, MASS.

advantage of æsthetic surroundings, except at Philadelphia, where the circumstances were unusual. At Munich, a home of art, the electrical portion of the exhibition was largely helped by the setting of statuary and paintings. The exhibition at the Crystal Palace, near London, was another instance of the kind, and the long, lofty aisles and transepts, the glittering roof and walls of glass, and the scattered sculptures and reproductions from the masters, were

However that may have been, the Exhibition at Boston can at least boast the occupancy of a very fine building. A few details will be interesting. The length is 600 feet, and the width 345 feet. These are imposing dimensions. The building, as will be noted, has its front broken up into three divisions, and by this means a more picturesque effect is gained. The exterior walls are of red brick, molded brick, freestone and terra cotta, and the

With regard to exhibits, the outlook at present is very good. There will be exhibitions by more than a dozen electric lighting companies, and all the leading lights will be shown. The Bell Telephone Company will have a good "exchange" exhibit, and will connect a miniature Bijou Theatre with the theatre of that name, and thus visitors to the Exhibition will be able to follow the play telephonically. Various telegraphic inventions will also be exhibited. The

application of electricity to the transmission of power to time telegraphs, hotel annunciators and burglar alarms will be illustrated in more than one practical device. The makers of all kinds of apparatus will show specimens of their skill and ingenuity, and other industries deriving support from electrical advancement will also occupy considerable exhibition space. The Bidwell Railway in operation is sure to draw and carry large crowds. The car is propelled and lighted by the same current.

While the American Electrical Exhibition will not be upon so extensive a scale as the late International Exhibition at Philadelphia, and is not conducted on the same strictly scientific basis, it ought to prove a success, and there are many indications that it will. Boston and the cities near it have a vast population whose high intelligence makes it likely that the number of visitors will be large. Bostonians are very much like the old Athenians in their keen appreciation of things new and wonderful.

The time fixed for the opening of the Exhibition was 10 A. M., Monday next, the 24th inst., and the closing day January 3, 1885; but as we go to press we are in receipt of a letter from the manager of the Exhibition stating that as the exhibits of the late Fair have not all been removed in season, the opening is postponed until Dec. 1. At the present time of writing, a great quantity of work remains to be done toward getting the Exhibition in readiness, but that, we are sorry to say, is nothing new as regards exhibition preparations.

The Electrical Light on English Transports.

To the Edison and Swan United Electric Light Company (Limited), was awarded, about eighteen months since, by the English Government, the contract for the lighting of all the Indian troopships by the Edison system.

The last week of October marked the completion of the contract by the successful introduction of the plant on board H. M. S. "Euphrates" and its official acceptance after two trial exhibitions of six hours' duration each.

Commencing operations in May, 1883, and continuing them during the period of each year when the troopships are idle in port, the company has fitted the "Malabar," "Crocodile," "Serapis," "Jumna" and "Euphrates" with electric lamps throughout, and it is most interesting to note the constant, rapid and important improvements exhibited in each installation.

We give below a table showing the successive plants:

Ship.	Lamps.		Dynamos.	Engines.	Revolutions per minute.
	Full.	Half.			
Malabar...	115	264	2 Edison.	2 Brotherhood 3 cylinder.	525
Crocodile..	98	288	2 Edison-Hopkinson.	ditto.	450
Serapis....	101	300	ditto.	2 Gwynne Invincible.	450
Jumna.. ..	97	300	2 Edison, improved.	2 Brotherhood.	280
Euphrates.	98	301	ditto.	ditto.	280

NOTE.—Full lamps are of 16 candle-power; half-lamps are of eight candle-power on the "Malabar," and 10 candle-power on the other vessels.

Each ship, in addition to the above, is provided with two large reflectors of 400 candle-power, to furnish light when slung at the yard-arms, for the embarkation and debarkation of troops, coaling, etc., etc.

The "Crocodile" has also masthead and side lights of 50 candle-power each.

The details of the march toward perfection in these past eighteen months are given below:

On the "Malabar" the machinery runs 525 revolutions per minute, 150 full lamps being the capacity of each dynamo; on the "Crocodile" and "Serapis" the speed has been reduced to 450, and on the "Jumna" and "Euphrates" to 280; and one dynamo now sustains all the lamps in each of the four latter ships (the other machine being held in readiness in case of accidents). On the two last-named vessels the one machine also supplies the two yard-arm reflectors.

On the "Malabar" it is impossible to substitute full for half lamps, or *vice versa*, the electromotive force required on the eight-candle lamps being insufficient for such variation, but on the others the light can be changed, trebled, if desired, at any locality, as occasion may demand.

The wood-casing which covers the wires has also been so perfected as to be a complete protection against all moisture, deck-washing, etc.; also against the intense heat of the stoke-hole. A usual safeguard against fire by damage to the electric wire is obtained by inserting a short piece of lead wire in the circuit of each individual lamp and main groups of lamps, which will fuse long before a dangerous elevation of temperature can be set up in the wires through any cause whatsoever.

In the matter of economy, the electric light places the balance upon the side most agreeable to electricians; where considerable over £200 was the charge for oil and candles, the electric light costs but little more than £100, giving a vast increase of light. These figures are the results of actual trial and severe tests, and are abundantly satisfactory to the English officials, to all directly benefited by the improvements, and those interested in the advance of electrical science.

Broomhall's Insulators and Pole Caps.

The cuts illustrating this article will give an excellent view of the inventions by Mr. George L. Broomhall, of Paterson, N. J., of a cap to protect the tops of telegraph poles from the action of the weather, combined with screw-pins, to which glass insulators can be easily and firmly adjusted, and extra points for securing wires be thus obtained at a portion of the pole not often utilized.

Fig. 1 represents the flat cap, covering the entire top of the pole. From its depending flange project lateral screw-pins, on which, as on the vertical pin in centre of cap, the glass insulators are shown as fitted. The flange, which sets closely to the properly rounded top of the pole, prevents splitting, and the wires bracing from these three newly provided positions give additional firmness to the

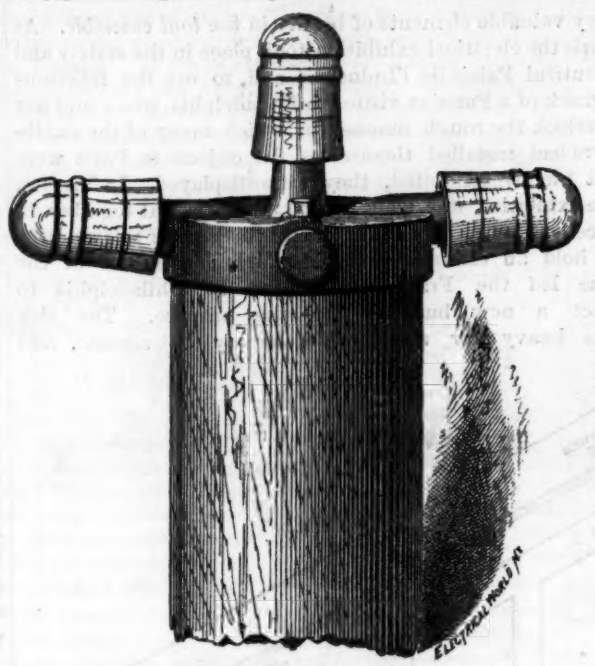


FIG. 1.

shaft. The cap is secured by a screw from its inner surface, which is sunken in the timber and by spikes through holes provided; or by pointed pins in place of the screw and inward projecting lugs on the inner circumference of the dependent flange.

Fig. 2 is a modification of the same idea and for like purposes. A metallic cap, with a vertical screw-pin to receive the glass insulator, is fitted on the top of the pole; the pins or prongs are driven into the pole, and it is further fastened by spikes through the holes provided in the plate.

The plates may be cast flat, as in Fig. 1, or conical, as shown by Fig. 2, and there are several other modifications described and claimed by the inventor in his specifications, whereby his caps and pins can be applied to poles under any and all circumstances and positions, insuring, by their use, preservation and increased firmness for the pole and

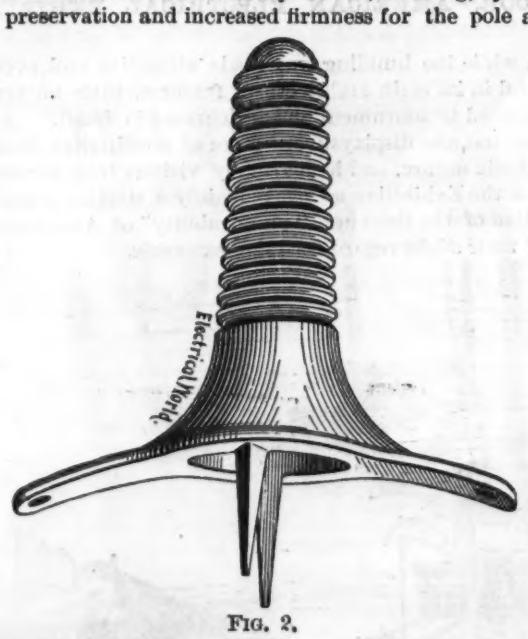


FIG. 2.

economy of pole surface with rapid adjustment and perfect insulation of wires.

Though these caps are of metal and sufficiently heavy and strong to bear any possible strain upon them, they can be furnished at a comparatively low cost and the advantages offered are worthy the consideration of all interested in aerial wire lines.

Submarine Mine Explosives and Fuses.

In his annual report for 1884 the Chief of Engineers, U. S. A., inserts extracts from the report rendered on investigations of submarine mines by General Abbot. In regard to explosives and fuses it is found that considerable progress has been made.

After much delay and difficulty a ton of explosive gelatine (without camphor) was secured from Robel's Explosive Co., of Glasgow, to compare with the camphorated sample of American manufacture in its fitness for torpedo service. Experiments are now being made and have shown that the imported article is, in explosive intensity of action under water, decidedly the best and the strongest explosive ever tested at Willet's Point. The Ordnance Department has obtained some of the article for trial, at the proving ground at Sandy Hook, in shell-firing from cannon.

The Danish submarine mining service exhibited at the electrical exhibition at Vienna, last year, a platinum wire fuse of sensitiveness far exceeding any made before that date, and a novel and promising system of operating mines was based upon that peculiarity which has been investigated with fuses even more sensitive and manufactured here of American materials, as samples of the Danish fuses or their wire could not be obtained. The Danish fuses were reported: Diameter of bridge wire in millimetres from 0.0005 to 0.000675; length of bridge wire 11 millimetres, of which 2 millimetres have the above fine gauge; resistance, from 9 to 14 ohms; firing current, from 0.38 to 0.05 ampères.

Sensitive platinum fuses, made similar to the Danish, from American wire, and subjected to electrical tests last April at Willet's Point, show:

No. of fuse.	Resistance in ohms cold.	Current in ampères to redden bridge.
1	...	0.021
2	57	0.022
3	75	0 020
4	57	0.020
5	54	0.022
6	76	0 020
7	80	0.018
8	51	0.025

The figures of this table prove that we have made a fuse of unequaled sensitiveness and uniform action which will enable engineers to experiment with many new methods of operating mines, and to introduce any favorable results into army service.

Those Election Returns.

We gave last week a few expressions of newspaper opinion on the alleged delay of and tampering with election returns by the Western Union Company. One or two more are given below.

The Brooklyn *Union*, an Independent Republican paper, says:

The telegraph system of the country should be absolutely divorced from politics; so should the closely affiliated system of news gathering, on which people of all shades of opinion depend for information. We have been disposed to attach but little importance to the loosely made accusations of manipulation of the election returns which have been made against the officers of the Western Union and the agents of the Associated Press. But if certain statements in this morning's *Sun* be correct these charges derive plausibility enough to require examination.

It must be evident that, apart altogether from the preposterous character of the figures sent out by Messrs. Somerville and French, this is business in which neither of them has any right to engage. Whatever may be their own political sympathies or those of their immediate employers, it is the obvious duty of men in their position to keep their minds as free from prepossessions as are the instruments that transmit the news; but no man not hopelessly blinded by partisanship could have sent out yesterday such claims as are attributed to them. It is bad policy in every sense for the Western Union or Associated Press to allow its news facilities to be used for the purpose of disseminating false political information. It may help a few gamblers to "hedge" on their bets, or give a parcel of political mercenaries time to see if there be a chance for a last grand stroke of fraud. But it hurts their reputation with everybody who wants to know the truth, and as the majority of people do, loss of reputation means loss of business.

The Providence *Mail* indulges in much stronger language:

There has been one apparent fact developed by the campaign of 1876 and the one just closed, and that is that the people of the country are at the mercy of a gang of unprincipled gamblers, many of whom are in high places and enjoying a degree of confidence ill consistent with their utter lack of principle. There is no reasonable doubt (and we speak of the matter entirely outside of party preference) that the delay in obtaining election returns is largely due to the manipulations of men who make fortunes or a living by gambling; by preying upon the prejudices, the hopes and fears of people and keeping a waiting country in suspense until they have arranged things to their satisfaction. If an election goes in the direction which these vampires and ghouls of society have made their bets, and the vote is so emphatic that there is no risk for them in a continuance of prompt returns, the country is quickly satisfied of the turn which the political tide has taken. If these soulless gamblers have made their bets heavily in one direction and an unexpected strength of popular feeling show that the tide is turning in the opposite direction, then they use all their opportunities for political and general corruption until they have had a chance to hedge. They cannot do this to advantage, of course, except in a close election, such as the present one and that of 1876, and then the fever of suspense is meat and drink to these vultures and buzzards of the battle-field.

The Exhibit of the Standard Electrical Works.

Although electric lighting was by far the most important element at the Philadelphia Exhibition, telephony and telegraphy were by no means relegated to an obscure background. Of the two latter classes, telephony was the more conspicuous, for, if we except the synchronous-multiplex system, the telegraphic display did not include many novelties. On the other hand, the Bell Company had an exchange in active operation in its costly and beautiful exhibit; the companies working or seeking to work under other than "Bell" patents showed what they had and could do, and the manufacturers of telephonic apparatus produced some very fine specimens of their skill. We illustrate on this page, in connection with our notices of the exhibition, one such display of apparatus, Fig. 1, made by the well-known Standard Electrical Works, of Cincinnati. All who visited the Exhibition will at once recognize the view and bear witness to the fidelity of the artist's work. The exhibit was tastefully upholstered, and the various productions of the Works were grouped on the walls and upon the floor in a manner that, while it pleased the eye, allowed also of an easy comprehension of the mechanism and principles of the apparatus submitted to public inspection. All the specialties of the Works were there, including the Painter patent ring-off magneto telephone bell; the McFall patent combination bell, Fig. 6; the Post patent combination bells; their latest extra territorial bells, Fig. 7, and extension bells; Philadelphia and St. Louis "Law" bells, and various other kinds of magneto bells. It was difficult, as one looked at this collection of bells, to refrain from murmuring some rather familiar lines by Poe, especially as the frequent inquiries and investigations of visitors led to a constant tintinnabulation in that cosy corner. The exhibit included also switch-boards of the ordinary "Standard" kind, club switch-boards, generators for switch-boards, hotel and office annunciators, the Stevens top-contact telegraph key, and the Stabler individual call. Our files will be found, on reference, to contain a great many descriptions and illustrations of the apparatus enumerated above. THE ELECTRICAL WORLD of Oct. 20, 1883, gives full particulars, with cuts, of the Standard switch-board for fifty lines, with six sets of connecting strips for as many tables. The club switch-boards were good examples of artistic work and of mechanical as well as electrical ingenuity, rich in appearance, occupying little space, and convenient in operation; Fig. 5. We refer our readers to the number of this paper of which date is given, for a full and interesting description of the switch-board class of apparatus. In our issue of March 8, 1884, is a four-page, profusely illustrated notice of the Stabler individual call-bell system, included in this exhibit. This system is the invention of Mr. J. P. Stabler, of Washington, D. C., and it seems to meet in a very ingenious and satisfactory way the difficulties attendant upon individual signaling. Briefly described the Stabler call allows the operator in charge to signal each subscriber on a given line individually, without any disturbance of the others. The principle of the call is that of step-by-step motion. The depression of one of the numbered keys arranged circularly on the face of the calling instrument causes an index hand in the centre of the circle to move, step-by-step, until it points to the key that has been depressed. Simultaneously the index hands of the instruments of each of the subscribers have executed the like movement. In this situation the index hand in the station wanted completes a circuit through the bell, which, however, does not ring until the "call-key" of the calling instrument is pushed down. None of the bells at the other stations being in circuit with the hands in this position, only the station wanted is called up. The system includes some admirable devices for securing unison of action on the part of the index hands upon the various subscriber boxes, for connecting two subscribers on the same circuit, for working over lines of greatly varying resistance without change of adjustment, and for producing and controlling in the central office the currents required. The Stabler call ought to be one means of introducing cheaper telephone service. Figs. 2, 3 and 4 show the main parts.

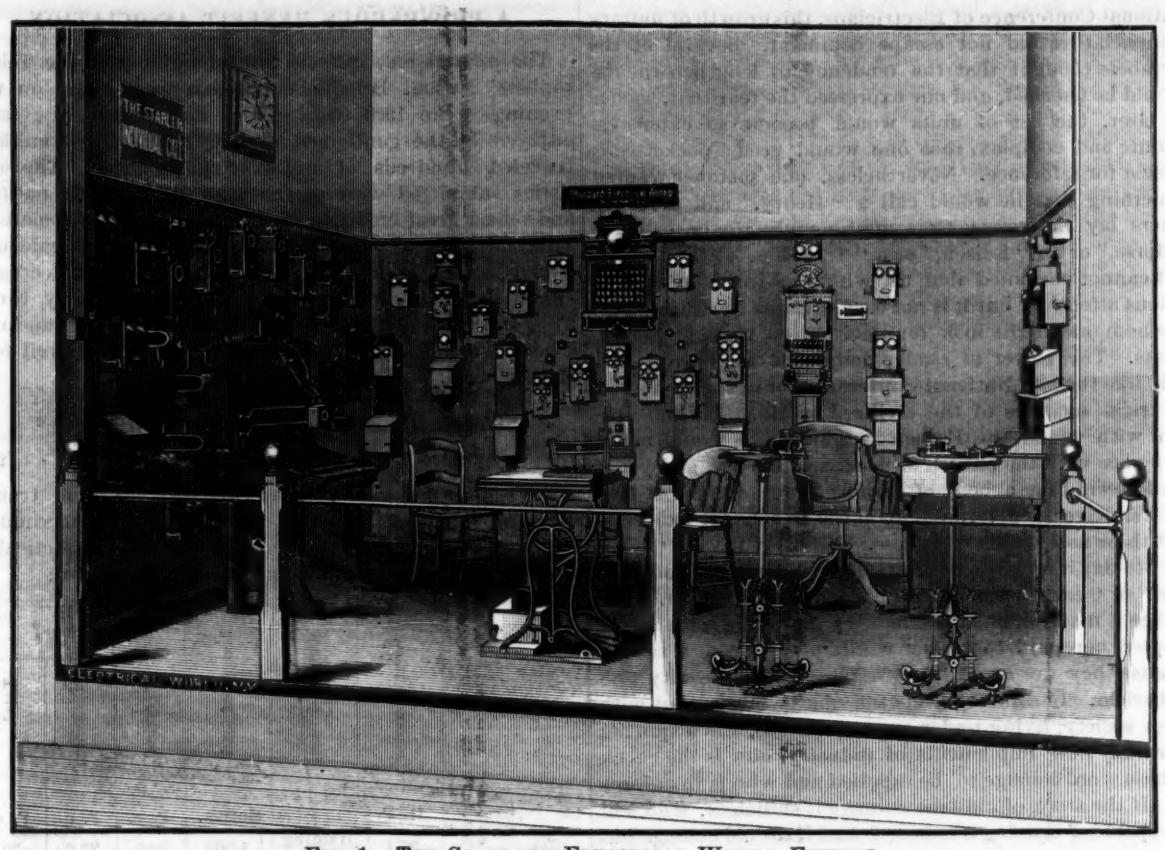


FIG. 1. THE STANDARD ELECTRICAL WORK S EXHIBIT.

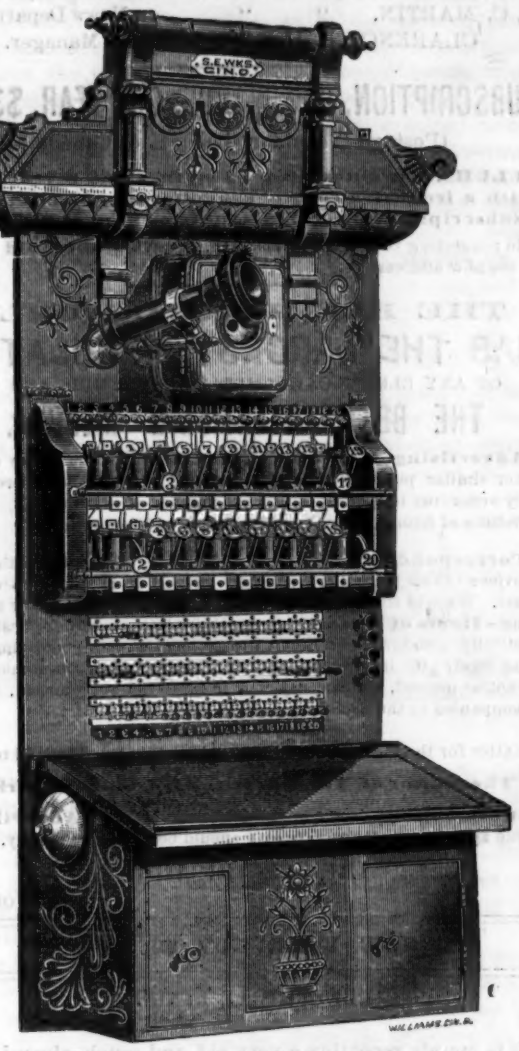


FIG. 5. THE CLUB SWITCHBOARD.

FIG. 2. STABLER CALL: SUBSCRIBER'S APPARATUS.

FIG. 4. STABLER CALLING APPARATUS COMPLETE.

FIG. 6. THE MCFALL COMBINATION BELL.

FIG. 3. STABLER CALL: CALLING INSTRUMENT.

FIG. 7. EXTRA-TERRITORIAL BELL.

From these brief notes it will be gathered that the exhibit presented to view much that deserved the attention of telephonists in particular and electricians generally. It must be mentioned, too, that additional information was conveyed to the mind of the visitor, untutored or expert, by the assemblage on a table in the foreground of the exhibit of all the numerous parts of the magneto bell.

THE ELECTRICAL WORLD

PUBLISHED WEEKLY,

AT NO. 9 MURRAY STREET, NEW YORK.

W. J. JOHNSTON, Editor and Publisher.
N. S. KEITH, Associate Editor, Scientific Department
T. C. MARTIN, " " News Department.
CLARENCE E. STUMP, Business Manager.

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THE ELECTRICAL WORLD,
NEW YORK.

NEW YORK, NOV. 22, 1884.

ELECTRICAL LINGO.

It is merely repeating a very old and much abused truism to say that things of great importance hinge on matters of very little apparent value. Some people try to dress the truism up in new garb, as when they say that had Cleopatra had a shorter nose than that she wore the course of the world's history would have been very different from what is recorded. Sterne's "Tristram Shandy" treats the speculation in one way, Whittier's "Maud Muller" in quite another, but under all forms and amid all variations the fundamental thought remains the same.

We publish to-day a letter from the vigorous pen of Mr. Thos. D. Lockwood, on reading which it was impossible to avoid recalling the truism we have referred to above. The circumstances are in themselves trivial. Last week we published a letter from Mr. Geo. W. Mansfield, who has been prominently connected with the Daft electric railways, making the suggestion that the man who runs the electro-motor should be called a "motoneer." Mr. Mansfield did not write as though he felt specially proud of the newly-coined word, but said he had found it useful, thought it might become more useful in the near future, and pointed out that it had already found its way into a book entitled "Wonders and Curiosities of the Railway." Hereupon, Mr. Lockwood is aroused, and with a trenchant blade sallies forth to fight for the purity of the language he himself is wont to use so expressively. Mr. Lockwood is indignant that this coinage should become current and refuses to handle it; and, by chapter and verse from Webster, he shows up the iniquity in which Mr. Mansfield is aiding and abetting.

Now, on the surface, a dispute over the word "motoneer" is hardly worth entering upon, but we take it that Mr. Lockwood, like ourselves, sees a great deal hinging on this little thing. At any rate, we seize the opportunity offered us of calling attention to the unsatisfactory state to-day of electrical nomenclature, technical and popular. That state will become more unsatisfactory in a very short time, as the applications of electricity are increasing every day, and there is practically no central authority to prevent any man from using any "lingo" that seems right in his own eyes. One cannot turn to any department of electricity without finding new words of dubious origin and conflicting use. Mr. Lockwood stamps the heel of his energetic contempt on "cablegram," but that is not the only word in telegraphy that sets on edge the teeth of the children of modern culture and scientific accuracy. In telephony, as Mr. Lockwood knows better almost than anybody else, a great many new words are coming up, and the succession of "electrophone," "microphone," "megaphone," "photophone," "radiaphone," "audiphone," and "aurophone," lengthens with the succession of the years—to say nothing of the new names fitted to the details of telephonic work. The electrical public has now grown accustomed to "dynamo," though it is not positively convinced whether the "y" should be long or short; and it accepts "magneto" with nonchalance. In electric lighting new words are increasing, and we hear the same lamp called "incandescent," "incandescence," and "glow." In connection with secondary batteries, the words "storage" and "accumulator" enjoy frequent occurrence and utterance. And then comes a long list of such words as "insulite," "bitite," "kerite," all being used for specialties, and familiar in electricians' mouths as household words.

In the formation, also, of a system of electrical units, there is another example of word coinage. We have all sorts of words derived from the names of illustrious men, but cut short or compounded as fancy or necessity dictates. Here crops up the difficulty, not alone of remembering the words, but of recalling their use and value. When Mr. Preece's new unit, the "watt," was under discussion in the National Conference of Electricians, this growth of unitary nomenclature did not escape comment. Several of the members thought that the tendency to lengthen the list should be checked, and one expressed the fear that, sooner or later, the list of units would become so extensive, minute and complex, that one would need a pocket *vade mecum* for reference. Nevertheless, one member wanted something that he would call a "Henry," and probably others lay in wait with something else to be called a "Morse," or an "Edison," or a "Thomson."

It cannot be denied that the whole subject is in need of serious attention, but it is not easy to name the authorities to whom one might look for decision on these philologic points. The power to render judgment might rest in a body like the late National Conference, or in the combined electrical societies of the civilized world. The deliberation with which the French Academy acts would never keep pace with the onrush of electrical science, and yet it would seem that a body of similar functions may sooner or later have to determine upon the reasons for existence that these new words can show. Yesterday it was "dynamo," to-day it is "motoneer," to-morrow it will be "radiaphonist" or "carboneer," or "synchronous-multiplexer." The charge is made against this country that slang is too freely adopted here and that new words are welcomed simply because they are novel, and despite their hybridity and barbarism. In some respects the charge is true, but with a new society, living under new conditions, and acquiring every day new implements of industry, how is the check on base word coinage to be applied and who is to enforce it? If the stock of old true coinage is sufficient, who will be capable of proving it to be so? And if the old coinage has to be melted down in order that new true coins answering to new wants may be furnished, who will do the minting?

PRIORITY IN PRINTING BY ELECTRICITY.

A few weeks ago, we had occasion to make some remarks on this page in regard to the priority of applying electricity to printing. We then said that the claim made by a weekly newspaper in a small town in this State, to be the first in the world to print by electricity, was without foundation, and we mentioned instances of earlier date. Up to the present time, however, the honor, if it be one, of being the *first* to print a paper by electricity rests with Mr. Davenport, to whom we have already attributed the achievement. It is stated specifically that on January 18th, 1840, the *Electro-Magnet and Mechanics' Intelligencer* was published in this city by him, and was printed on a press worked by his electro-magnetic machine. We have tried to find copies of that paper, but have not yet succeeded in doing so. If any of our readers are in possession of the evidence, we shall be glad to hear from them. A gentleman in Philadelphia says that in one of the public libraries of that city there is a pamphlet about Davenport and his machine and speaking of printing by electricity. We hope in time to discover the pamphlet, as it would certainly be interesting to clear up the matter.

THE POPULARITY OF COPPER WIRE.

One of the most evident and pronounced facts in connection with the leading electrical industries and applications is the popularity now enjoyed by copper wire of one kind or another. For various reasons iron wire is not the great favorite it once was, and though there is still, and will continue to be, a great demand for it, copper wire is increasingly sought after and used by electricians. We have watched this development, going on in Europe not less than here, with considerable interest, and have now placed before our readers the first of a short series of articles covering the whole subject of overhead wires for telegraphy, telephony, electric lighting and the transmission of power. His study of the questions involved has enabled Mr. Wm. Maver, Jr., who contributes the articles to our pages, to give the electrical public some new and valuable information. We think the articles will afford a very good idea of the processes of electrical wire manufacture in America, and furnish an explanation of the present tendency toward the wider use of copper.

FIGHTING FOR SUPREMACY DOWN SOUTH.

Those who follow the course of telegraphic events are aware that, for some months past, the Western Union Company and the Baltimore & Ohio Company have been actively thwarting each other's plans and operations in Texas. We have from time to time published the details, from which we gather that the Western Union has been anxious to prevent its antagonist from gaining a substantial foothold in that portion of the country. A dispatch this week from New Orleans reports a settlement of one attendant litigation. The suit involved the question of the condemnation of Morgan's Louisiana & Texas Railroad, between New Orleans and Vermilionville, for the new line of the Baltimore & Ohio Company. The case at last reached the jury, who have now awarded damages to the railroad company of $2,1 0. The amount asked for by the Western Union Company was a bagatelle of $20,000, and the railroad company modestly estimated at $40,000 what it had to sell. The small sum now awarded has been paid into court, and the merry war goes on.

A PROSPEROUS BENEFIT ASSOCIATION.

The annual meeting, election and dinner of the Telegraphers' Mutual Benefit Association took place on the evening of the 19th inst., in this city, and were greatly enjoyed by the gentlemen present, many of whom had traveled hundreds of miles to participate. The statistics submitted were of the most encouraging nature, and reflect great credit on the officers of the Association. This body, one of the oldest of its kind, has now paid out a quarter of a million dollars to the relatives of deceased members, and has, in round numbers, nearly three thousand names on its books of members in good standing. The showing is one of which telegraphers may well feel pleased with.

Electric Transmission of Power in Mines.*

BY PROF. W. S. SCHULZ.

The author deduces from the executed electrical transmissions of power tabulated below that the maximum electrical efficiency of the receiving dynamo practically attainable is 50 per cent. of the transmitting motor:

NAME OF PIT.	Power of motor	Machine driven	Length of lead	Efficiency. Electrical	Mechanical	Total
La Peronnière, near Rive-de-Gier	37.1 H. P.	Hauling machine.	1,500 Metres.	50.0 P. c.	37.0 P. c.	30 P. c.
Thibaut, near St. Etienne	5.0	"	250	45.0	38.0	25
Blanzy	17.0	"	634	....	51.0?	30
Zankerode	14.7	Loco.	893	46 6?	37 8?	30
Zankerode	5.0	Fan.	780	50.0	26.0?	....
St. Claude, near Blanzy	8-10	"	900	...	...	...

On this basis he compares the cost of electrical transmission of power with the actual cost of transmission by compressed air and water applied to rock-drills and coal-getting machines, locomotives, cable and rope-hauling machines, and ventilators, and finds the former more costly than other methods, except where air is compressed by steam power without being cooled, and in the case of locomotives for haulage on levels. The comparative cost of such haulage in actual operation is given in the table:

UNDERGROUND HAULAGE BY LOCOMOTIVES.

	Steam. Dornan pit.	Steam. Cesson pit.	Compressed air. Petan's system.	Compressed air. Mekarski's system.	Electricity. Zankerode pit.
Cost of plant	Marks. 32,000 d.	Marks. 32,000 d.	Marks. 13,000 d.	Marks. 20,000 d.	Marks. 16,000 d.
Interest, etc., per ton-km	0.264	0.091	0.490	0.502	0.276
Cost of haulage per ton-km	0.372	0.316	0.736	0.841	0.680
Total cost per ton-km	0.636	0.407	1.226	1.343	0.956
Daily work	488 Ton-kms.	1,421 Ton-kms.	106 Ton-kms.	159 Ton-kms.	235 Ton-kms.
Length of line	2,320 Metres.	4,627 Metres.	620 Metres.	620 Metres.	620 Metres.
Speed "	2.3	3.3	1.5	1.5	2.6
Weight of engine	4,400 Kilogms.	8,000 Kilogms.	2,700 Kilogms.	2,300 Kilogms.	1,600 Kilogms.
Engine, height	1.92 Metres.	2.1 Metres.	..... Metres.	1.55 Metres.	1.5 Metres.
" width	1.30	1.6	.....	1.10	0.8

For the separate ventilation of a lateral drift of the Zankerode mine, a 40-inch Schiele fan is used, driven by a Siemens dynamo actuated by a Dolgorouki steam engine; the cost per 1,000 cubic metres is 0.27d., which is cheaper than transmission by compressed air only where a special compressing plant for the small fan has to be put down. The author concludes that there is no field for electrical transmission in mining, special cases excepted, except for hauling on levels by locomotives, which could advantageously replace rope or cable haulage.

* A paper read before the Institute of Civil Engineers.

The T. M. B. A. Annual Meeting.

The annual dinner and election of the Telegraphers' Mutual Benefit Association was held on the 19th inst. at D'Orville's restaurant in the Washington Building, Bowling Green, this city. James D. Reid, the founder and first president of the association, presided at the dinner. Among those present were W. H. Young, the Western

Union manager at Washington; W. G. Jones, superintendent of the Baltimore & Ohio Telegraph Company at Philadelphia; W. B. Gill, Western Union superintendent at Philadelphia; J. M. McRobie, of Chicago; C. R. Tracy, of Wheeling; J. W. Dyer, R. J. Bloxham, of Baltimore; S. A. Duncan, of Pittsburg; G. D. Maize, of Philadelphia; J. W. Tillinghast, of Buffalo; P. L. Watson, of Brooklyn; G. G. Ward, superintendent of the Bennett-Mackay cable; J. L. Edwards, Clarence Cary, S. S. Garwood, Charles P. Bruch and M. H. Redding. Quite a number of telegraphers from Philadelphia, Chicago, Detroit and Buffalo were present. About 100 gentlemen sat down to dinner.

A letter was read from Jay Gould, who said that an important engagement prevented him from being present, and Cyrus W. Field wrote that an out-of-town engagement compelled him to decline the invitation, but that the asso-

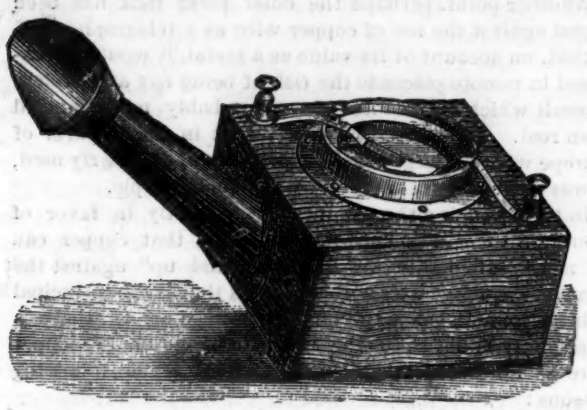


FIG. 1.

ciation had his best wishes. Speeches were made by President A. R. Brewer, James D. Reid, "Senator" Ives, T. C. Martin, Mr. Tinker of the Western Union, and others. A humorous recitation was given by T. F. Clark, and several selections were sung by the Manhattan Quartette. In his speech President Brewer stated that there were at present 2,780 members in the association, which had paid to the families of deceased members $250,000 during the term of its existence. The following officers were chosen for the ensuing year: A. R. Brewer, of New York, President; W. H. Young, of Washington, Vice-President; Charles F. Bruch, of New York, Sec'y; W. H. Baker, Treasurer, and A. R. Brewer, J. Merrihew, W. B. Gill, Joseph Uhrig, C. Smith, W. H. Young, Joseph L. Edwards, W. H. Baker, and Charles P. Bruch, as the members of the Executive Committee.

Early Telephonic Instruments at the Exhibition.

About three months ago, as we duly noted at the time, Dr. Van der Weyde brought before the New York Electrical Society a number of telephonic instruments copied by himself after the original Reis designs of 1860, and of which he had given exhibitions at the Cooper Union as far back as 1869. Since we reported the proceedings of that meeting the instruments in question have received much attention. They were recently to be seen at the Electrical Ex-

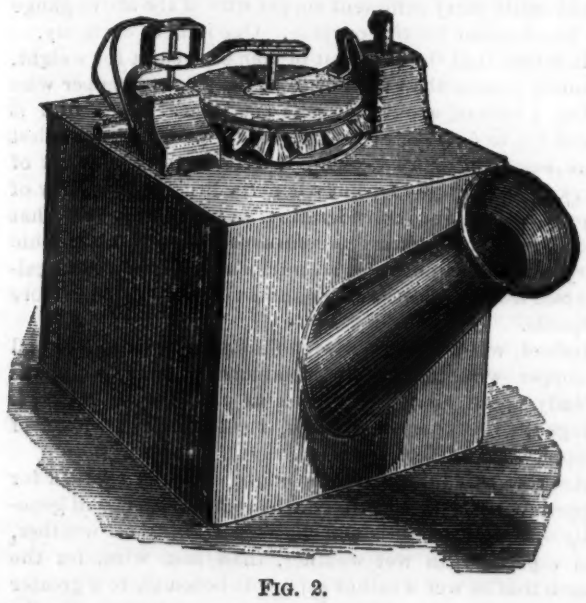


FIG. 2.

hibition. Our English contemporary, the *Electrical Review*, has deemed it worth while to make illustrations of the instruments, and we therefore take the opportunity of reproducing them. The description is as follows:

But the most interesting part of the exhibit—indeed one of the most interesting exhibits of the Exhibition, was the set of telephonic instruments invented by Prof. Van der Weyde, and exhibited by him at the Cooper Institute, New York, in 1869. His transmitter is very like those of the box form of Reis, only that he substituted an india-rubber membrane for that of parchment and added an adjusting screw to regulate the pressure of the contact point, as seen in Fig. 2. We may mention that the instrument shown in Fig. 1 was made in 1868, from a description published in Kessler Pesko's "Technical Physics," issued in Vienna in 1866. In 1869, the year following, Prof. Van der Weyde's next attempted improvement on the Reis was effected (see Fig. 3). It related to the receiver and consisted in substituting a bundle of thin wires of varying lengths instead of the solid bar, his idea being that he would thus avoid the dominant tone of the solid bar. It is evident, indeed Prof. Van der Weyde himself asserts, that he did not believe the transmission of words to be possible, and therefore all his experiments on the subject of telephony were directed to the successful transmission of inarticulate sounds. His next attempt was (to quote his own words) "to make use of the magnetic charge of one end of the bar by causing it to attract a button of iron," which he attached to a spring. Finding, however, that the spring had a pitch of its own depending on the length and thickness of the spring supporting the iron button, his attention was again turned to vibrating plates, on which subject his first public lecture was delivered as far back as 1832.

He soldered an iron button to the centre of a brass plate (Fig. 4), placed in front of an iron bar, surrounded with a coil, and this was the instrument used as a receiver at the lecture of January 8, 1869. In August, 1870, he read a paper before the American Association for the Advancement of Science which that year assembled at Troy, N. Y., the paper being entitled "Further improvements in the method of transmitting musical melodies by telegraph wire." In the discussion which followed the reading of the paper, one or two of the members present stated that they had obtained good results by placing a tinned iron plate in front of the poles of a horseshoe electro-magnet, and mentioned this as a well-known device; and on arriving at home in September, 1870, he constructed the apparatus shown in Fig. 5, in which a tinned iron plate was used. The inventor states that when he experimented before the Polytechnic Club of the American Institute on January 7, 1869, several of the persons present stated that they heard distinctly the *words* of the song performed at the other end of the line. Prof. Van der Weyde did not himself credit this, and ascribed their impressions to imagination.

Talmage on Telephonic Tap.

Negotiations touching the trial in the Rev. T. De Witt Talmage's Tabernacle of Mr. Frank C. Mason's recent telephonic invention have been completed, and the work of perfecting the details of the experiment will be pushed on

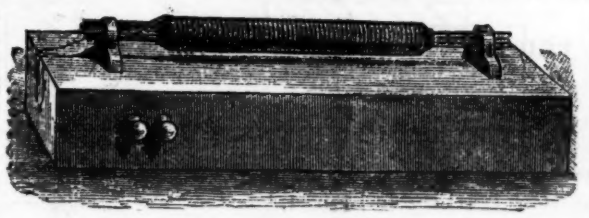


FIG. 3.

this week. It is expected that on Sunday, the 23d, the apparatus will be in readiness for the test. A wire will be connected with the Brooklyn Central Telephone Office, and from that point Talmage's discourse will be served hot from the speaker's mouth to numbers of people in Brooklyn and New York. The *Sun* says:

Mr. Mason is the superintendent of the Brooklyn police telegraph. He has been studying his invention for some time, and making experiments at his home which have been very satisfactory. It is not a new transmitter he has made, but an adjustor to the common transmitter now in general use. The trouble with the common transmitter has been that it could not be kept long in a delicate adjustment. When very finely adjusted it would take up a few words and then become disarranged from the concussions of the sound waves. This caused it to buzz and rattle, making conversation impossible. Mr. Mason has invented an appliance which not only makes it possible to adjust the platinum point more delicately toward the carbon button, but when thus adjusted it is held firmly and securely. He has thrown transmitters that he had so adjusted, roughly about and found them unimpaired.

"There is no pulpit in the Tabernacle," he said, "so I shall be obliged to put the transmitter on the organ, back of the speaker. Whether the jarring of the heavy bass notes will throw it out of adjustment is something I am interested in testing. It does not make the least difference whether the speaker talks at the instrument or away from it. If it holds its adjustment it will take up the sounds. I have regarded the invention more as a plaything than anything else, and have taken no steps toward having it patented. I should prefer not to go into the details of its mechanism, however, as what I shall do with it in the future depends upon how more extensive experiments turn out. If it succeeds in Dr. Talmage's church it will be kept there permanently, and I suppose there will be nothing to prevent subscribers to the telephone service having Dr. Talmage's sermons on tap, just as they do their water and gas. There are several private lines from churches to houses, although I don't know of any general experiment, such as the one we are contemplating. Mr. Beach of the *Scientific American* built, and he still maintains, a line at his own expense from his residence in Forty-second street, New York, to Henry Ward Beecher's church. The transmitter used is the common kind, but it is placed under the pulpit, and the speaker talks more or less directly into it. I understand that it works very satisfactorily. Two invalid ladies living in First place here in Brooklyn have a line running from their house to Dr. Ludlow's Westminster Church in Clinton street and Second place. It works well I am told, the transmitter being, as in the case of Mr. Beach's line, directly in front of the speaker.

"I have the utmost confidence in long-distance telephone circuits, and have no doubt that we might as well talk with Boston as with Harlem. The trouble is that companies will not go to the extra expense which the putting up of the right kind of wire demands. The wire should have a steel core to give it toughness, and over the steel should be a copper covering to serve as a conductor. This is, of course, expensive. I have talked with perfect ease from New York to Cleveland, Ohio."

Electric Lighting in Railroad Cars.

We note statements in the New England papers that indicate the successful opening here of another field for electric lighting, one that has been the subject of much

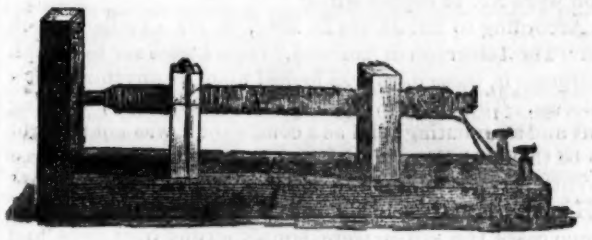


FIG. 4.

discussion and experiment among practical electricians. We refer to the lighting a few days, or evenings, since, of a car on the Providence and Hyde Park line, by electric light. Twelve incandescent lamps, of about 12 candle-power each, furnished an illumination delightfully satisfactory to the passengers and in every way surpassing oil or gas light.

Four batteries of six cells each, carried in the car, supplied the current for the lamps, which were of the Woodhouse and Rawson patent. The bichromate battery invented by M. Trouvé, who is the originator of many other electrical appliances, is a wooden trough enclosing several ebonite cells, in each of which are one zinc and two carbon elements, and these are connected by movable clamps and attached to a windlass which lowers or raises them into or from the exciting solution as the intensity of the current may require. By several new and ingenious devices, provision is made for the proper performance of details and the easy management of the whole battery. An india-rubber covered spindle supports the elements and the zincs are notched at the top to facilitate their handling and rapid arrangement.

Besides the many highly important purposes to which M. Trouvé has applied electricity, such as motors for every-day use and comparatively light work, the adaptation of

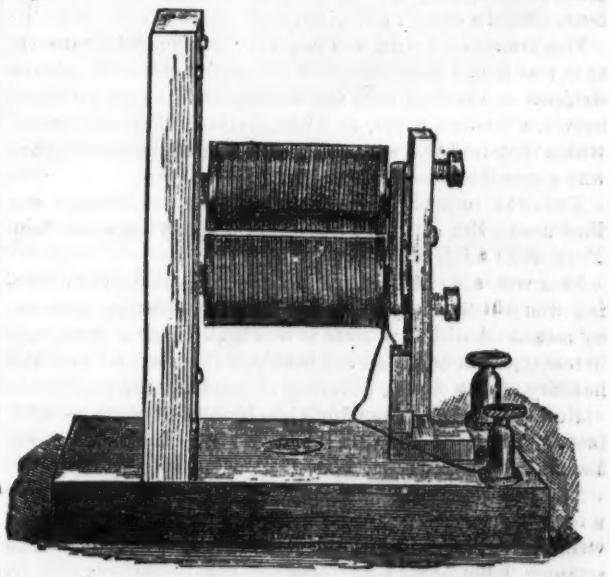


FIG. 5.

the electric light to the use of surgeons in uterine and rectal examinations, etc., etc., it is to his ingenuity that the theatrical and ball-going community are indebted for the small battery, capable of being easily carried about the person, whereby articles of jewelry, containing a small incandescent lamp, may be made to blaze with ten times the dazzling power of the breast-ornament of a minstrel-show's "end man." Such jewelry has already been used in London society, and by the sylphs of the ballet; and its effect is certainly most brilliant. In THE ELECTRICAL WORLD of August 9, 1884, we published a full-column notice of this application of the electric light, and gave several illustrations of the new idea.

The Domestic Electric Light and Power Company, of Boston, have control in this country of M. Trouvé's inventions, and are pushing them most energetically; they are now engaged in manufacturing a portable electric lamp, in the base of which is placed the small battery supplying the current.

Overhead Telegraph Wire.

BY WM. MAVER, JR.

Part I.

The recent adoption by several of the leading telegraph and telephone companies of hard-drawn copper wire as an overhead conductor, has led to numerous inquiries as to the particular nature of this material and its advantages over iron for that purpose; and as to the meaning of several of the technical terms used in referring thereto, such as tensile strength, elongation, etc.

In view of the interest thus generated I shall attempt in the following article to give a detailed description of the manufacture of iron and copper wires, the advantages which they respectively possess, and the methods of testing telegraph wire, not only mechanically but electrically, before its delivery to the purchaser.

If it shall come about that copper wire shall be extensively used to replace iron as an overhead telegraph wire—and in the opinion of many well qualified to make the assertion, such will eventually be the case,—it will but furnish another instance of history repeating itself; for the first wires built by Morse between Baltimore and Washington were No. 14 copper wires.

According to Mr. James D. Reid, in his excellent book on "The Telegraph in America," copper wire for telegraph purposes in those days was looked upon as anything but a success. The wires were continually breaking, drawing out and attenuating; and as a conductor it was not thought to be the ideal telegraph wire. But in the light of past events it is not so much to be wondered at that the wires did not work satisfactorily as that they worked at all. In some cases the wires were simply strung over trees, and the best insulation that was given them consisted of a coating of pitch and tar. A notch was made in the pole, into which the wires, covered only with a piece of cloth saturated with the same insulating substance, were placed. A board was then nailed over the wire to keep out the rain.

A sample of another insulator is shown in Fig. 1. It consisted of 2 plates of glass, between which the wires were placed, and over this a board cover.

Fifteen poles to the mile were allotted, with a view of lessening the total leakage of the electric current at the poles. Thirty poles to the mile are not now considered any too many.

Fifteen poles to the mile gives a span of about 350 feet between poles. It is therefore not surprising that sleet storms played havoc with wire strung in this fashion; stretching, sagging and breaking it. Consequently, when Mr. Reid, having on one occasion run short of copper wire with which to repair a break, made the discovery that signals could actually be sent through iron wire, it was the cue for an immediate replacement of the copper by iron wire, and what remained of the former was sold as old copper.

Since then, until within a very short time, iron wire has held almost undisputed sway as an overhead wire in this country.

The first important inroad into its domain was made some years ago by a compound wire composed of a steel centre with a copper covering.

This compound wire was not very successful, however, as it was found that wherever the copper covering became stripped or cracked and moisture thus obtained entrance between the two wires, an electrolytic action was set up which impaired the wire. The size of this compound wire was about No. 4 or No. 5 gauge.

The next important attempt at a compound wire was that used by the Postal Telegraph Company between New York and Chicago.

This wire also had a steel centre, and the copper covering was placed on the steel by an electroplating process, by means of which process it was hoped that a closer adherence would be preserved between the metals, and the liability of the copper covering to crack or strip thus be obviated—an expectation which has been in a measure realized. The gauge of this wire is No. 4. Its resistance is about 1.7 ohm per mile.

The Bell Telephone Company is now experimenting with a metallic circuit composed of No. 12 hard-drawn copper wire between New York and Boston, and the results so far attained have been, I am assured, highly satisfactory, so much so that it is contemplated to build a similar metallic circuit between New York and Philadelphia.

The Baltimore & Ohio Telegraph Company has now in successful operation about 4,000 miles of No. 14 hard-drawn copper wire, and it is understood that this fast-growing company intends making a much more extensive use of this metal as a line wire, than has hitherto been essayed by any other company in this country; and it is an open secret that other companies are only awaiting successful results from the experiments of the above mentioned enterprising people, before building new wires of this material, or even replacing some of their old iron wires with it. For it is generally admitted that hard-drawn copper wire is at present undergoing a trial, and one which is being watched with the greatest interest by all concerned.

At least one scientific gentleman of prominence in electrical circles has staked his professional opinion on the prediction that it will prove a failure; but on the other hand, other gentlemen of equal renown have expressed the opinion that with proper treatment in the factory and in construction it should be a success.

The fact, however, that hard-drawn copper wire is now undergoing a trial, and that so much depends upon its success, as we shall see, is nerving every one connected with it, both in its manufacture and its erection on the poles, to do their best, and this will have the good effect, at least, of insuring it a fair and intelligent trial, the results of which will perhaps settle the question as to its fitness as an overhead telegraph wire.

In the face of these facts it is not surprising that inquiries should be made for information concerning this subject.

As every one knows, the principal requisites for a telegraph wire (and by that term I wish to be understood in this article as referring to overhead wires) are low resistance, high tensile strength or breaking strain, ductility, with a high percentage of elongation, and cheapness.

With low resistance we get a greater strength of current from a given battery on a given length of wire. High tensile strength insures the wire against breaking, unless from some unusual cause; ductility is an excellent adjunct of high tensile strength when the two qualities can be combined; and a high percentage of elongation gives a good margin for the strains caused by the variations of temperature—sleet storms, etc.

Of course, so far as conductivity is concerned, there is no question as to which metal—copper or iron—should be chosen, copper offering a resistance to the electric current of about 1 to 7 as compared with iron; but the advantages of tensile strength combined with ductility and elongation have heretofore all been on the side of iron.

By tensile strength is meant the strain which anything will sustain without breaking.

For example, if I should hold in my hand one end of a hempen cord and to the other end should add pound after pound of weight until the cord breaks at, say, 20 pounds weight, then the tensile strength, or breaking strain, of the cord is 20 pounds.

By ductility is meant the flexibility of the wire, for instance the number of times it may be bent backwards and forwards or twisted until it breaks.

By elongation is meant the stretching qualities of a wire, as when it is said an iron wire should stretch 18 per cent. of its length without breaking.

Now, it is well known that iron is a much harder and stronger metal than copper, so that a piece of the former,

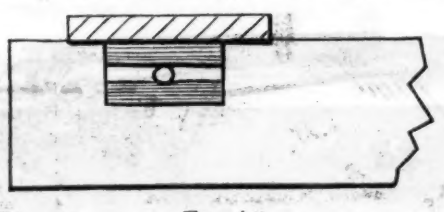


FIG. 1.

of an equal thickness with a piece of copper will, with an equal degree of ductility, have a much higher tensile strength than the copper.

As a rule, the higher the tensile strength of a metal is made the less ductility and elongating qualities does it possess; in other words, the nearer does it approach brittleness.

Thus, a piece of copper wire, No. 14 gauge, having a tensile strength of, say, 300 pounds, will scarcely stand being bent back on itself more than seven or eight times. If the same wire should he given a tensile strength of 370 or 390 pounds, it will, in some cases, have become so brittle as almost to break at the first bend.

An iron wire of the same size could be given a tensile strength of about 510 pounds and yet stand more twists and bends than the copper wire of less strength.

There is no real necessity, however, that either metal should be given as high a tensile strength as the above, it having been fairly well established that a wire which will sustain two and one-half times its own weight per mile, is amply sufficient for all practical requirements. Therefore, as the weight of No. 14 copper wire is 110 pounds per mile, and iron of the same gauge 97 pounds per mile, the tensile strength of copper need not rise above 275 pounds, and iron 152 pounds, and it is quite probable that at least in the case of copper it may transpire that even this figure is really higher than is absolutely necessary.

For, assuming that there are about 30 telegraph poles per mile, it follows that the actual weight of itself that copper has to sustain between each pole is somewhat less than 34 pounds. Between that and 275 pounds is a very large margin for the pressure of wind, wet snow or sleet, on the wire.

There is, however, as already said, another property of metals which has to be taken into consideration in this relation, and that is, elongation; in other words, the stretching qualities of a wire, and this quality also decreases as the tensile strength rises.

In soft copper this feature of elongation is quite marked and it has the detriment that when it has been stretched it does not resume its former length, at least not to the same extent as does iron under similar circumstances.

As an instance of this I may state that this very fact is considered a serious impediment to the use of copper in cables which are intended for submersion in very great depths, inasmuch as should it become necessary to raise such a cable to repair it, the strain on the cable is so great that it stretches, and when the strain is removed the iron and gutta percha being of a comparatively elastic nature resume their normal positions, while the copper does not, and it is thus bunched up, as it were, at places in the cable and thereby runs a chance of causing a serious fault by connecting with the armor of the cable.

Again, where soft copper wire might be used on the same poles with iron wires it is also likely that in time they would sag and perhaps in consequence cross with the iron wires, which would not have sagged to an equal extent. But in hard-drawn copper wire the elongation is reduced to from 2 to 4 per cent., which as compared with iron wire is quite low, the latter running up to 14 and 18 per cent., yet taking the average for hard-drawn copper wire as 3 per cent., and assuming that there are 176 feet between poles, this would leave a margin of about 5 feet for elongation.

Another point, perhaps the chief point that has been urged against the use of copper wire as a telegraph wire, is that, on account of its value as a metal, it would be exposed in remote places to the risk of being cut and stolen, a result which is, in these days, probably more fancied than real. It is a fact, however, that in many parts of Europe where a large-sized copper wire was formerly used, it was frequently carried off by dishonest people.

In the foregoing the advantages are mostly in favor of iron, but if it can be shown, practically, that copper can be made sufficiently strong to "stand up" against the elements equally well with iron, and that is the principal point of issue in the experiments now going on, there is hardly any doubt as to the ultimate adoption of copper wire as an overhead telegraph wire for the following reasons:

Copper is much more durable than iron when exposed to the action of the atmosphere.

It is so much better a conductor than iron that there is hardly room for comparison between the metals on that point.

A copper wire having a diameter of 83 thousandths of an inch, equal to No. 14 Birmingham wire gauge, will offer but little more resistance to the passage of the electric current than an iron wire having a diameter of 220 thousandths of an inch (equal to No. 5 gauge).

This fact offers many advantages, both electrical and otherwise.

For instance, it is well known that the electrostatic capacity of a wire has a great bearing on the successful working of automatic and multiplex systems, and the greater the electrostatic capacity of a wire the greater the detrimental effect ensuing to those systems.

It is equally well known that, other things being equal, the electrostatic capacity of a wire increases with the size of the wire; consequently the copper wire possesses a decided advantage over iron in this respect.

As it is thus possible to get equal conductivity from a copper wire, weighing 110 pounds to the mile, to that from an iron wire weighing 670 pounds, it might be feasible, in the event of the general adoption of copper wire, to use smaller and less expensive poles, cross arms and insulators.

Again, when a break of any magnitude occurs on a line requiring the renewal of a portion of an iron wire line, it is necessary that the lineman should hire a horse and wagon to carry the iron wire to the scene of the break, whereas he could easily carry sufficient copper wire of the above gauge on his shoulder for the purpose. One item of economy.

It is true that the first cost of copper, weight for weight, is much greater than that of iron, the price of copper wire being, I believe, about 20 cents per pound, while iron is about 4½ to 6 cents, according to the gauge, the smallest wire being the dearest, owing to the greater amount of work required upon it; but when the greater durability of copper is taken into consideration, as well as the fact that even when copper wire becomes useless for telegraphic purposes, it still possesses an intrinsic value, while old galvanized iron is quite worthless, its economy is yet more palpable.

Indeed, when it is considered that an iron wire, to equal a copper wire in point of conductivity, must weigh, as already stated, about five times as much as the latter, it brings the first cost nearly even, if not slightly in favor of copper.

Another advantage which might well be claimed for copper wire is that with equal conductivity it will generally operate more satisfactorily in all kinds of weather, and especially in wet weather, than iron wire, for the reason that in wet weather each pole becomes, to a greater or less degree, a path by which the current escapes to the ground; and the amount so diverted will be in proportion to the relative conductivity of the wet insulators and poles, and the wire itself. But as an iron wire, to possess the same conductivity as a copper wire, must be much larger, a much larger surface of the iron wire is therefore presented to the insulator than by the copper wire, and consequently a larger proportion of current follows the pole to the earth from the iron wire than from the much smaller copper wire.

In view therefore of the many points in which copper wire is so superior for telegraphic purposes, it appears rather surprising that iron has so long held almost undisputed possession of the poles.

This may, however, I think, be accounted for in various ways. For instance, in the early days of telegraphy it is quite possible that the copper wire furnished Morse

was altogether unsuitable for the purpose to which it had been put; which is not at all to be wondered at. Electric telegraphy was at that time an experiment, and it was not to be expected that the wire then produced could have been manufactured with any distinct understanding as to what would be required of it. The historians of those days tell us the wire was unannealed, and it is fairly assumable that the first copper wire had a very low tensile strength, which, with the manner of its erection on the poles, etc., doubtless tended strongly to breakages.

This with the high price of copper probably created a deep rooted prejudice against that metal regarding its use as an overhead telegraph wire.

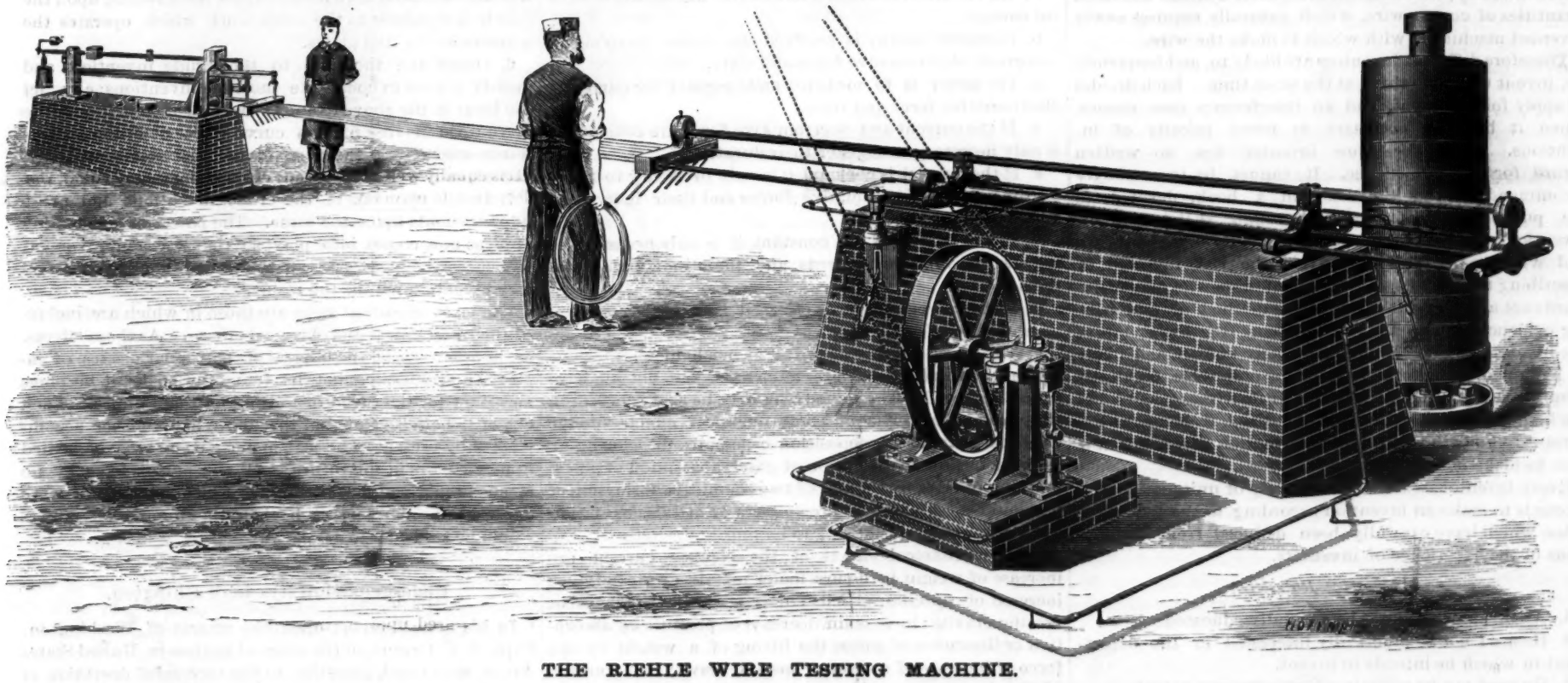
But apart from the above there is no question that iron wire was quite equal to the requirements of the telegraph service for the first twenty or thirty years of its existence when only single Morse wires of No. 8 and 9 gauge were used. It was when multiplex and fast automatic systems came into vogue and demands arose for better conductors that the question of again using copper for that purpose began to be mooted in earnest, and the development of the vast mines of almost pure copper in the Lake Superior regions added zest to the idea.

In the meantime, to meet the needs of the service, the size of the iron wires was being rapidly increased until thousands of miles of No. 4 iron were put into operation.

Mechanical Wire Testing Apparatus at the Exhibition.

At the Electrical Exhibition recently held in Philadelphia was shown a Multiple Wire Tester, Stretcher and Straightener, manufactured at the Philadelphia Scale and Testing Machine Works, Riehle Brothers, proprietors.

This machine was built for the Trenton Iron and Steel Company, of New Jersey. We are glad to place before our readers an illustration and description of that useful apparatus. The question of the strength of wire is one interesting to every electrician. The tester consists of a weighing mechanism (seen on the left, with a capacity of 4,000 pounds), two single or alternating pumps, a hydraulic jack, a patented three-way valve, and a rising and falling



THE RIEHLE WIRE TESTING MACHINE.

accumulator. The weighing end of the machine placed horizontally and secured by bolts to a foundation is accurate, and will weigh the strain on one to six wires at a time. It is provided with self-adjusting grips to take in wires from No. 10 to No. 16, and hold them firmly. It can be adapted to take in a larger or smaller range of numbers when desired. There is a set of gripping appliances at both ends, and in the present instance they are 90 feet apart—one set at the scale end, and the other secured to head of piston. The jack is 5 feet in length and lined with brass; its outside diameter is 3½ inches; its inside diameter 2¼ inches. Like the scale end, it is firmly bolted down to its foundations. The plunger has a stroke of 4 feet. It is supported and guided by three guides, the top one being a straight tube running on turned rollers. A three-way valve controls the movements of the jack and accumulator, and supplies water to the jack by a lever. When the lever is raised, the water is forced into the larger area of the jack, causing the plunger to move backward and bring a strain on to the wires of other specimens; when the lever is lowered, the water in the larger area of the jack only returns to the reservoir of the pump (to be used again). Now, without changing the position of the lever, the plunger will return automatically, without weight or counter-balance, with a steady, smooth and uniform motion. The pump has a slow motion—60 revolutions per minute. It has two single-action pistons, and the valves are so simple and readily accessible that an ordinary mechanic can examine and repair, when necessary, in a short time. The accumulator is so arranged as to overflow when it comes to its maximum height. The machine can be adapted to stretching and straightening wires in lengths to a given amount. The weight on the scale and that on the accumulator is made to correspond, so that wires of a certtain number or size can be quickly tested in quantities under exactly the same conditions, with only the movement of the lever.

Electricians are very well aware of the importance of having wire good in mechanical qualities, that is, a wire that with a high percentage of conductivity has great tensile strength and ductility. Many of them who visited the Exhibition were therefore interested in the operation of this machine and its fellows, shown by the same firm. But the importance of a machine of this kind is not fully appreciated at first. Wire is coming more generally into use daily, not alone in electrical applications but in every field of industry. Thus other uses are found for the machine. For instance, it is necessary in baling hay or like substances that the wire should not stretch. Otherwise it would allow the bales to increase in bulk, and serious accidents might follow if the bales, when packed in warehouses or shipholds, absorbed moisture and, being unhindered by the wire, swelled to such an extent as to bulge the walls or the sides of the vessel. By the use of this machine the wire can be stretched judiciously, just enough to take the elasticity out of it, but not enough to impair its strength.

The firm manufacture testing machines of all sizes and descriptions, of which particulars can be obtained from them in the usual way.

Underground Wires Discussed in Boston.

The regular meeting of the Boston Society of Arts was held at the Institute of Technology, on Nov. 13, Prof. Charles R. Cross presiding. The paper of the evening, on "Underground Telegraph Wires," was read by Dr. W. W. Jacques, electrician of the Bell Telephone Company. Dr. Jacques stated that the problem was by no means a new one, as the original Morse telegraph line was commenced as an underground wire, and was elevated only when moisture was found to completely forbid its working. The introduction of gutta percha again brought the subject to public attention, but the great expense and difficulties of underground telegraphy have never been completely overcome. A description of the different European systems in use since 1852 followed, that of Paris being especially noteworthy, from the fact that all the wires of the city are laid underground, the vast system of sewers presenting advantages not possessed by any other city. The cables are supported by hooks on the walls of the sewers, which are of great size, so that any break in the connections can be easily remedied. A great enemy of all underground systems is water, an enemy which is not always repulsed by the use of gutta percha, since coal gas, vegetable growth and other agencies seriously affect that substance. How to avoid induction currents has always been the most puzzling problem, answered, unsatisfactorily as regards expense, by the employment of complete metallic circuits in the cables, instead of earth connections. From a table giving the results of a great number of experiments, made by himself on the various European systems, Dr. Jacques has deduced the following empirical law, which promises to be of importance in the practical construction of underground lines: "If the product of the total capacity in microfarads multiplied by the total resistance in ohms of an underground telephone line be less than 18,000, conversation can be carried on over the line with perfect ease. If the product be over 18,000 and less than 30,000, conversation will be difficult, though possible. If the product be over 30,000, conversation will be impossible." A description of the two cables recently laid in Boston by the Bell Telephone Company was given, and the surprising statement made that more underground wires existed in Boston than in all European cities, except Paris, combined.

At the conclusion of the paper, Prof. Cross called upon Prof. A. E. Dolbear, of Tufts, who stated that his experience in underground telephony corroborated all that Dr. Jacques had said, and that the law given by the latter was of great interest and value. In the present state of telephonic knowledge it is impossible to present a good commercial system which shall depend entirely upon underground cable lines. Prof. Cross gave an account of a series of tests conducted by himself during the summer on the experimental cable of the Bell Telephone Company.

The Disruptive Discharges from the Holtz Machine.

M. Jamin lately presented to the Paris Academy of Science a paper on this subject, by the Abbé Maze, of which the following is the substance: When a Holtz machine is employed, the exciter of which is so constructed that the spark may be drawn, at will, to the right or left of the axis of the apparatus, it is found that the position to be given to the movable part of this exciter is far from being a matter of indifference. Thus, if the movable part be left complete with its balls and its condenser; if, besides, such a position be given to the two movable branches that the ball which disengages the positive electricity be nearer its condenser than the other is from its condenser; in a word, if symmetry be broken by carrying the opening of the balls from the positive side, there will be obtained, with a mean distance between the two, two narrow brush discharges of unequal length, the larger corresponding with the positive pole. These brush discharges do not unite, but produce slight dull detonations. If, without in any way modifying the rest of the machine, the side of the opening be changed, so that the positive conductor be the longer, the phenomena become quite changed.

It is no longer possible, whatever be the distance between the balls, to obtain detonating discharges, but always the ordinary crackling spark. The absence of symmetry may also be demonstrated by removing the ball of the positive pole. If, in that case, the interception be on the side of the negative pole, the discharge will attain at most half the preceding length. If the ball of the negative pole be removed, the influence of symmetry will not be so manifest. These experiments may be repeated after removing the condensers, when the phenomena are generally of the same order as in the former case, but much less intense. Besides, it is not only optical phenomena which prove the importance of the question of symmetry, mechanical facts lead to the same conclusion. In fact, if, after having deprived the exciter of its balls, a strip of paper 10 centimetres by 20 centimetres be suspended between the points, with the opening on the side of the positive pole, the paper will be strongly repelled by the negative pole; but, on the other hand, if the interruption take place on the negative side, the paper will be repelled by the positive pole.

This experiment succeeds with or without the condensers; but the result is more strongly marked when they are suppressed. It is worthy of remark that if the branches of the exciter are placed symmetrically with respect to the axis of the machine, repulsion is manifested by the positive pole when Leyden jars are used, and by the negative pole without them. In conclusion, the Abbé Maze remarks that he has confined himself to simply stating facts, without formulating any theory; but he considers that the causes of the phenomena observed are to be sought in a reciprocal induction of the various parts of the machine.

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

The idea comes first, then the thinking, and finally the new product of the mind, whole and complete in the shape of an invention. But how did the idea come? It is often exclaimed, upon hearing of a new and simple invention: "If I had only thought of it!" This remark seems to mean, when analyzed, that if the idea had only occurred it would have needed very little exercise of the brain and little knowledge to develop it into a material device. Some attribute the creation of the idea to genius. This is right, provided it is remembered to apply the right definition to the word. I do not now intend to enter into definitions, nor to review any of the theories on the creation of ideas, but to offer distinct and exhaustive directions concerning how to invent.

In literature, new ideas come into the mind only when it is in an active state. The best ideas have come when the mind has searched for them in an analytical, progressive or inductive manner.

Composition in literature has been common to mankind from the beginning of history. Inventions to meet necessities of life have been numerous only of late. In the former department, men have learned to proceed according to predetermined thought, while in the latter, ideas have been attributed almost entirely to accident. In this article it is desired to overcome this false notion of accidental invention and to establish general rules, which, if studied with diligence, will lead present inventors to multiply the number of their inventions, and those who desire to invent to satisfy their longing.

In the course of human events and from the growth of civilization, men ask for more and more inventions, because each invention necessitates auxiliary inventions. For instance, the telephone, which is a success, needs the invention of an effective conductor which will not permit of induction from adjacent currents; the dynamo needs a commutator that, if at all, will spark only in case of an accident; the telegraph needed, and finally has obtained, means whereby two or more messages may be transmitted simultaneously; all electrical inventions demand increased quantities of copper wire, which naturally requires newly invented machinery with which to make the wire.

Therefore different inventors are likely to, and frequently do, invent the same thing at the same time. Each decides to apply for a patent, and an interference case ensues, when it becomes necessary to prove priority of inventions. Often the true inventor has no written record for direct evidence. It cannot be too strongly recommended, that he keep in a book, devoted to the purpose, descriptions, with rough sketches of his inventions, and have the contents duly dated, signed and witnessed. This will avoid the risk involved in describing the invention to acquaintances who may afterwards act as witnesses. This latter method of establishing evidence incurs the risk of losing the ownership of the invention by its becoming publicly known, and likely to be stolen. The former method is preferable, because it is only necessary to have the signature witnessed and not the invention. This point is emphasized, it being as important to know how to keep an invention as it is to know how to make it.

Every inventor, whether consciously or unintentionally, proceeds to make an invention according to the following rules, which have carefully been deduced from observations of the experience of inventors.

Negative Rules.

1. An inventor need not be generally educated.
2. He need not be practically interested in the department in which he intends to invent.
3. He need not be acquainted with present patents.
4. He need not be acquainted with facts in chemistry or physics.

These negative rules are likely to be severely criticised; but let inventors speak for themselves and let not the theoretical philosopher spend the time in wondering why it is not requisite for an inventor to be a well-informed man. Scientific education is an advantage, and in all scientific professions it is absolutely necessary; but hundreds of inventors exist and succeed who show by their example the truth of the above rules. There is one thing, however, he must know or learn, and without which it is hopeless for him to try to invent; and that is a knowledge of the principles involved in the department of industry or science in which he intends to invent.

All principles which he has learned or may pick up here and there are useful. The necessity of the possession of principles will be apparent if it be borne in mind that all inventions are applications of principles. If one does not know the principles, then how can he apply them? Some inventors, upon hearing of a principle new to them, and especially upon discovery of a new principle, immediately set to work to apply it to some new and useful and original invention. To show how to apply principles is undertaken in the following rules, which, however, will be valuable only according to the diligence with which the rules, as well as the principles, are applied.

Before considering the rules, notice the difference between a principle and a fact. A principle is a general law comprehending or including many subordinate facts; a fact is the event, or something which has actually transpired. To know one principle is to know a multitude of facts. Conductors are heated by the electric current, is a principle. A platinum wire has been used by the electric current, is a fact.

A device for hatching chickens, game, etc., and consisting of a coil of wire within a box containing the egg or eggs, said wire being heated by the electric current, is an application of a principle, and is, therefore, an invention, and as far as I know it is new, being simply an application which I invented for the purpose of illustration.

Positive Rules.

1. Choose a department of industry or art in which you desire to invent; for example, electricity.
2. Choose a sub-subject; *e. g.*, electrical meter.
3. Write down in a book all the principles which you can think of and which show in themselves any possibility of application to the sub-subject. Write them in a book, as they may not only be valuable for the particular sub-subject in hand, but also for certain other sub-subjects. Below are given principles, classified into chemical and physical, and probably applicable by such as desire to turn their thoughts to them. Some of these principles have already been applied and some have been applied in such a different and strikingly original manner that there is, no doubt, room to apply each principle repeatedly to new inventions. Some are not known to have been applied at all as yet.

Principles may be stated as effects, *e. g.*, the effect of the electric current is the heating of conductors. An effect of heat is the expansion of metals, etc., and therefore the word effect will hereafter be used, since it allows the principle to be stated in a preferable light for the present purpose. The principles, or effects, will be found in the next rule.

4. Answer to yourself by long and continued thinking the question: "What is the object of the invention?" Consider this question, not five minutes, but several days. Think, think, think, until you not only know what is the definition of the device, but also just what the device is intended to accomplish. The thoughts are likely to occur in the following progressive order:

a. An electrical meter is a device for measuring electrical energy.

b. Electrical energy is resolved into three components—current, electromotive force and time.

c. The meter is to measure and register the currents, electromotive force and time.

d. If the current and electromotive force are constant it is only necessary to register their duration.

e. If the current is constant it is only necessary to register the variable electromotive forces and their individual durations.

f. If the E. M. F. is constant it is only necessary to register the variable currents and their individual durations.

g. If the current produces effects it is only necessary to measure the effects.

h. The effect is either chemical or mechanical.

The chemical effects are numerous, but not all have been discovered. The same thing may be said concerning the mechanical effects. Some chemical effects of the electrical current are deposition of metals, discoloring or coloring of liquids, liberation of gases, absorption of gases, marking of lines by contact of two chemicals, formation of precipitates, solution of precipitates or metals, oxidation of metals, the explosion of gases.

Some mechanical effects of the electric current are increase of weight by deposition of metals or precipitates; increase of specific gravity; decrease of weight or of specific gravity; increase or decrease of pressure by absorption or liberation of gases; the lifting of a weight by the force of increase of weight or specific gravity; the rotation of wheels, operation of levers, etc., the operation of the same by the force produced by the increase of weight or specific gravity; the difference of level of a liquid by the variation of specific gravity or weight; the raising or lowering of a column of mercury or other liquid by the increase or decrease of weight or specific gravity, or by the liberation or absorption of gases, the rising of the mercury, making, alternately, electrical contact to close the current which runs the index hands on the dial plates; the increase or decrease of pressure produced by liberation or absorption of gases, lifting or lowering a vessel inverted over a liquid and employing the force of motion of said vessel; the alternate increase or decrease of weight, specific gravity or pressure; the vibration of a pendulum by the increase or decrease or alternate increase and decrease of weight, specific gravity or pressure, or by the making and breaking of current; the increase or decrease of volume; the vibration of a string, wire, plate, spring or other body capable of vibration; increase or decrease of weight, specific gravity or pressure; overcoming or releasing the resistance of a spring by force of said increase or decrease; moving a cam by said force, the curve of the cam being that whose co-ordinates are proportional to the electromotive force and current; moving a lever by motion of said cam; marking a line with the point of said lever upon a moving surface; moving the core of a solenoid against the resistance of a spring or weight; marking a line with the point of the core of the solenoid; producing, by means of the force of the moving or alternately moving core any of the effects above mentioned which are produced by increase or decrease or alternate increase or decrease of weight, specific gravity or pressure; marking dots and dashes by one or more moving or alternately moving cores; deflecting a magnetic needle; operating a delicate registering apparatus by said deflections; completing and breaking of current alternately by said deflections; operating registering devices by said alternate currents; turning a small electric motor; registering angular velocity and time of revolution of said motor; registering some given work performed by said motor, said work being the turning of fanned wheels in air or in a liquid, lifting weights, etc.

The object of an electric meter is to produce and register one or more of these effects automatically.

5. Having determined analytically, as illustrated, "What is the object of the invention?" the next step consists in a decision; *i. e.*, decide upon some one device or chemical which will accomplish this object. Almost any person, acquainted or but slightly acquainted with some principles of electricity, can devise at least a rough instrument or meter to begin with as a foundation for improvements. Think, then, until you have in your mind or represented on paper a device which might be called a meter. Upon thinking further, one improvement will follow another, until after several days and, perhaps, weeks of intense thought, and perhaps after only a few hours, you will have made so many improvements that the last improvement will have added, together with the others, so much as to entirely change the primary meter into a meter worthy of a patent. Some will ask if the improvements will ever stop. The inventor has little satisfaction with his invention up to a certain point, when, by overcoming the last difficulty, he may go on thinking for days and yet he has exhausted his mind in this direction; all difficulties have been overcome, and therefore a point is reached where he is satisfied.

The fifth rule may be stated in general terms, thus:

Plan in the mind or on paper a crude device, process or chemical which will accomplish the object, never mind how imperfectly; *e. g.*, let a core of a solenoid operate a cam, the co-ordinates of which are proportional to the current and electromotive force. Let a lever resting upon the cam be a regulator to the clock-work which operates the pointers on the dial plates.

6. Direct the thoughts to the crude invention and modify it so as to constitute multiple inventions; *e. g.*, let the lever in the above example operate a pencil point to mark upon moving paper a curve whose co-ordinates represent respectively the current and electromotive force, and whose area represents the electrical energy.

7. Decide upon one of the crude inventions and make improvements upon the same. The power of association of ideas now comes into play, so that one improvement will successively suggest another, until finally a satisfactory invention will be the result.

The most important steps are those in which are included the mechanical and chemical effects. As those effects, or, in other words, the objects of particular classes of industrial articles, cannot be found in books, it becomes necessary for the inventor to think of them himself. Each one of the effects stated in the above list is either accomplished by present practical meters, or may be embodied in new meters in the future. All the effects have by no means been given, but if three or four instruments were devised to accomplish each, then the number of meters would be sufficient to supply the market.

Underground Wires in Washington.

In his annual report upon the streets of Washington, Capt. F. V. Greene, of the corps of engineers, United States Army, pays much attention to the successful operation of underground electric wires in Washington. Substantial progress was made during the year, he says, 6.11 miles of line and 285 miles of wire being laid underground. The report says that the Standard cables have been in constant use without a fault for telephone, telegraph and fire alarm purposes for nearly a year. The telephone wires using the Western electric cables have also been in constant use for about six months, and are eminently successful. The Bankers and Merchants' and Postal wires are also in daily and successful use.

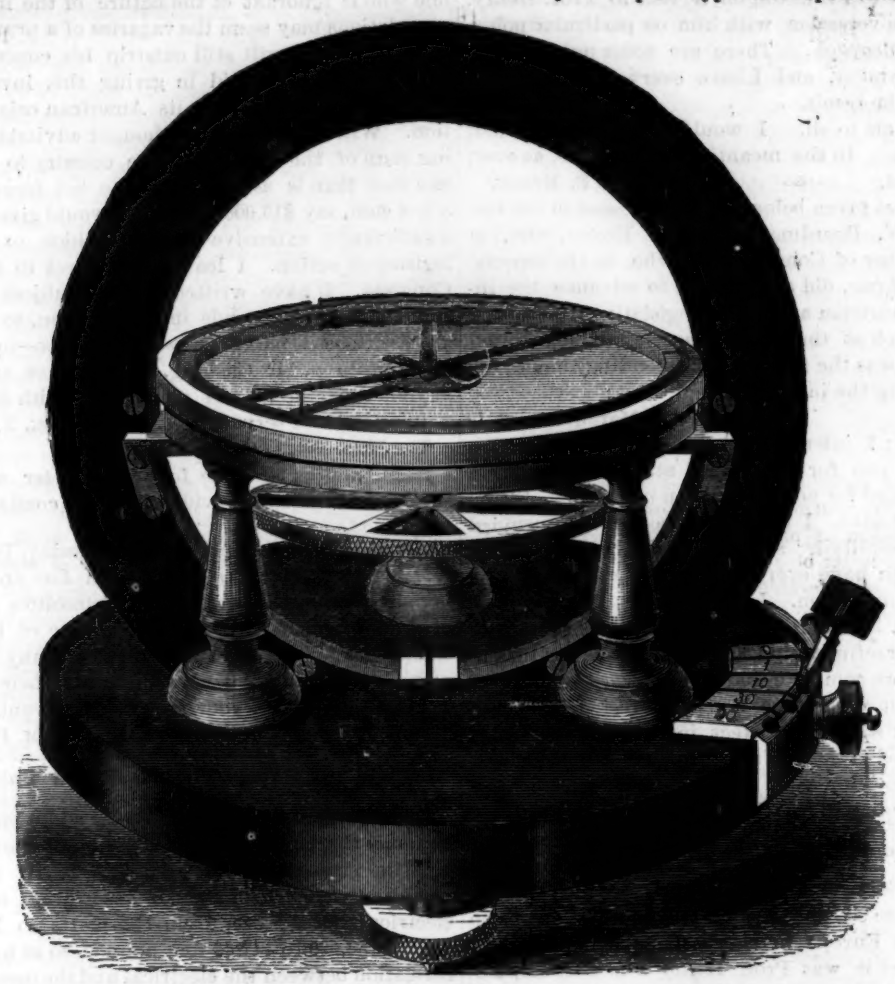
"The Western Union Company, which has one-half of all the mileage of overhead wire within the city limits," the report says, "is alone in refusing, or at least in neglecting, to take any steps toward burying its wires, although urged to do so by the Commissioners. All applications for new poles for the telegraph companies, or for removing their pole lines have been uniformly refused. Their wires are now much interfered with by the growing trees, and in order to get their wires out of the foliage they have resorted to the expedient of splicing the tops of their poles. But the trees will soon overtake them, and this and the rotting of their poles will in a few years compel a settlement of the matter, even if legislation is not obtained requiring the removal of their main pole lines. * * * The close of this year will see about 800 miles of underground wires for telephone, telegraph, and electric light purposes in full and successful operation in this city. It would seem, therefore, that the day had passed for discussing the feasibility of underground wires, and the time has come for compelling the removal of all overhead trunk lines within a reasonable period."

Galvanometers at the Electrical Exhibition.

IV.

(*Continued from page* 179.)

Tangent Galvanometers.—Having given exhaustive instructions for standardizing a tangent galvanometer, and described some imported instruments, the next step consists naturally in describing instruments of the kind, American make, and stating their uses and methods of using for various purposes.



WESTERN UNION STANDARD TANGENT GALVANOMETER.

The Western Union Standard Galvanometer represented in the accompanying cut, taken from instruments exhibited by the Western Electric Co. of New York, Boston and Chicago, consists of a base of hard rubber of the best quality to prevent any possibility of shrinkage or swelling by dampness or heat, and of a size of about eight inches, supporting the instrument proper.

Upon the base are three supports for the dial plate and coils. The coils are wound with differently sized wires for the purpose of measuring currents of various electromotive forces. The resistances of these coils are respectively 0, 1, 10, 30, 90. To give a resistance practically zero, no wire is used, but there is substituted a band of copper of considerable cross-section, and of a length corresponding to a single coil. By connecting all the resistances up as may be done by means of a plug, the total resistance of 131 ohms is thereby obtained. These particular resistances of 0, 1, 10, 30, 90, and 131, are chosen not according to any scientific principle, nor for use in any particular formula, but because they have been found to be most generally useful. When the plug is to be used for connecting up all the resistances, it is a combined plug and binding post and may be inserted in the resistance hole marked 131 in instruments built for higher electromotive force than that indicated in the illustration.

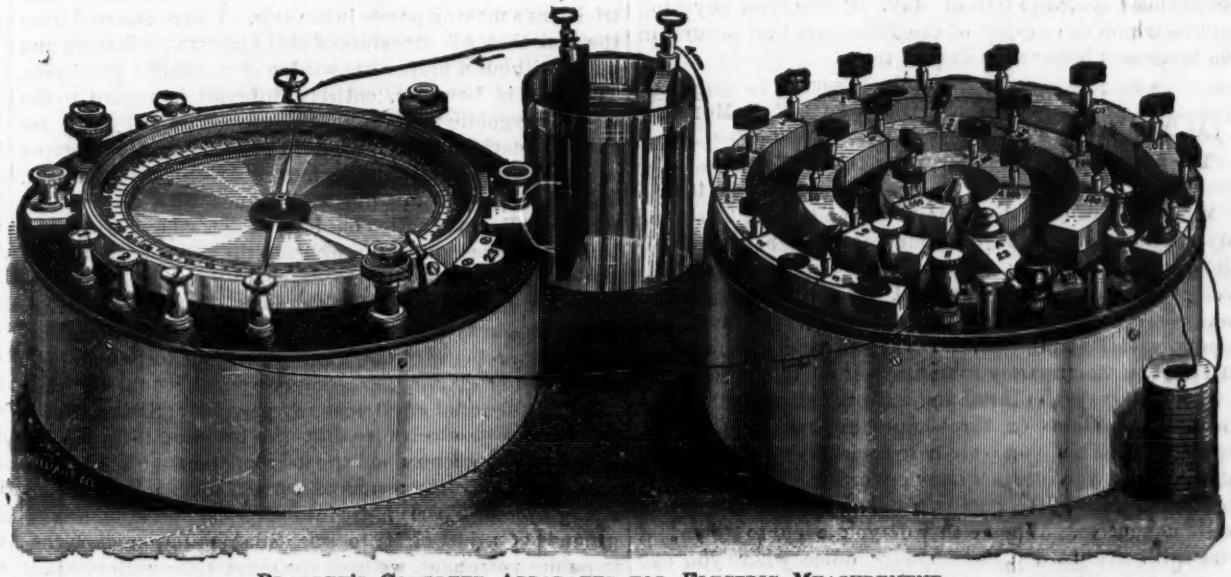
The needle is lengthened by means of an aluminum pointer, of five inches, and equal to the diameter of the dial plate, and supported by a jewel upon a point, the aluminum pointer being fastened at right angles upon the magnetic needle. In the last article was mentioned the fact that for the instruments there described it was necessary to look up tangents for the angles of deflection from a book or table of tangents. In the present instrument, however, it is only necessary to look at one end of the pointer for the angle, and on the other for the tangent of that angle. This is at the same time convenient and accurate, for it is not necessary to have the tangents of any smaller angle than of even degrees, and those are the tangents given.

If there is any precaution more important than another in the construction of this instrument, it is that the centre of the needle should be exactly in a vertical diameter of the ring, and preferably at the centre of this diameter. The instrument, as a whole, may rightly be considered as appearing to be several times more bulky than necessary for mere strength; but it is built heavy for a purpose, and that purpose is to provide an instrument which will not be influenced in its dimensions and relations of parts by the atmosphere and by handling. Strength in tangent galvanometers is more important than slender and graceful beauty. As the actual instrument is highly polished, and as it consists of various shades of metal and hard rubber, it does not appear as heavy as is indicated by the cut where the above-named properties cannot exhibit themselves.

The uses of a tangent galvanometer are: The determination of electromotive force; resistance and strength of batteries, and of the resistance of wires, carbon filaments, solenoids, dynamos; locating faults, breaks and crosses on telegraph lines or cables; measuring the amount of metal deposited in any given time by the current; the determination of the specific resistance of solids and liquids, and the calculation of efficiency of storage batteries.

Bradley's complete apparatus represented in the illustration taken from instruments also exhibited by the Western Electric Co. consists of the tangent galvanometer on the left, the rheostat on the right, and the galvanic cell in the middle. It is represented as connected up for measuring the resistance of a solenoid whose terminals are connected with the proper binding-posts of the rheostat, or Wheatstone bridge. The rheostat measures resistances varying from $\frac{17}{100}$ to 10,111 ohms. By putting in resistance, by means of the plugs, the resistance of the solenoid is finally balanced, so that by reading the sum of the resistances and dividing or multiplying, if necessary, by multiples of 10, the resistance of the solenoid becomes known. The plugs must be so removed or inserted that the needle comes to zero. The solenoid may be replaced by an incandescent lamp, circuit of telephone, or telegraph, or by any conductor whose resistance is to be determined.

The binding posts of the galvanometer are numbered so that No. 1 represents a coil of high resistance and is intended for currents of high electromotive force, while No. 4 is for low electromotive force. Binding posts No. 2 and 3 are for medium currents. Binding post *B* is the other terminal of either coil. The galvanometer by means of these coils combines an ordinary detecting galvanometer with an ordinary tangent galvanometer.



BRADLEY'S COMPLETE APPARATUS FOR ELECTRIC MEASUREMENT.

This article brings to a close all that is of importance and new concerning galvanometers at the Exhibition, but we hope in a future number to continue this series of articles on measuring instruments, with one on the electrometers exhibited at Philadelphia.

Proposed Combination of Electro-Motor Interests.

It has been believed generally that nothing but jealousy, on the part of the various companies owning or controlling electro-motor patents in this country, has hindered the wide use of such motors and their application to railroads for traffic purposes.

Mr. Rowland R. Hazard, President of the Gramme Electrical Company, is familiar with the progressive steps that have recently been taken in applying electricity to railway service. He made the following interesting statements to a *Times* reporter this week, "In May last Mr. Reed, of Portland, Oregon, who is President of the United States Electric Railroad Company—an organization formed to work the patents of Mr. Edison and Mr. Stephen Field and generally known as the Edison-Field Company—interested himself to effect a combination of all the railroad electrical patents in the hands of one corporation. He believed that such a combination would lead to more substantial and speedy results than could be otherwise attained. Negotiations were undertaken at that time between Cyrus W. Field, David Dudley Field, and Mr. Reed, and myself as the representative of several interests. These negotiations, however, failed of success, because Mr. Edison required the repayment to him of certain sums of money expended in the construction of the Menlo Park Railroad, all of the other persons concerned being willing to combine their patents and to waive all demands for the repayment of their experimental expenses. The matter has rested in that position until the present moment.

"The presence of Sir William Thomson, one of the most eminent electricians in the world, at the recent electrical exposition in Philadelphia, revived interest in this subject, and the attention of men interested in the Manhattan Railway Company was called to it. Mr. Cyrus W. Field in particular has shown much interest in the subject of electric motors as affecting his railway investments. He has become satisfied that the electric railroad is practicable for the elevated service; that it would be more efficient than steam at a greatly reduced cost; that it would diminish the strain on the structure by removing the heavy locomotives; that it would enable the running of one more car to each train, and finally that it would remove the annoying products of combustion from the public streets. I understand that Mr. Cyrus Field personally favors some sort of competitive trial of motors at the expense of his company, but my own impression is that no such competitive trial need be made, since it would involve a large expenditure of money and a considerable loss of time without any adequate result.

"The electric motor is a very old invention, and the best type is not identified with any of the inventors who would be called on to compete. What is required is not an efficient motor alone, but a complete and effective system by which any number of trains may be worked electrically as they are now worked by steam. There is no doubt but the interests of the art and the progress of practical work would be forwarded by some form of combination, and that suggested to me by Mr. Grosvenor P. Lowrey, formerly a director of the Edison Company, appears to be the best practical solution of a somewhat difficult problem. His plan was to organize a company for the manufacture of plant and the equipping of railroads, this company taking an exclusive license from all those now organized for railroad purposes and holding valuable patents. The respective companies would, of course, maintain their organizations and derive their income from the manufacturing company, receiving such proportion of its total earnings as might be agreed upon or awarded by a competent board appointed for the purpose."

"It is said that a meeting of electricians and capitalists interested in electrical appliances is to be held for the purpose of effecting such organization as you describe," said the reporter, interrogatively.

"Yes. I understand that a meeting will be held," answered Mr. Hazard, "and it is possible that some better plan than the one suggested by Mr. Lowrey may be found. The Gramme Company was organized with the object of

effecting a consolidation of all the electrical companies, and I have been committed from the beginning to that policy. Its failure to be realized as to the electric lighting companies has been fatal to the interests of many of them, which fact they realize now when it is too late to remedy the disaster. I earnestly hope that the same suicidal policy will not be pursued by the companies owning railroad patents There is no reason why the whole city service, both elevated and surface, should not be electrically equipped. I have within a few days made a tender in behalf of the Brush Company to equip a service of 210 40-foot carriages for railroad service. We propose to dispatch trains of four cars, under one minute headway, at the rate of 12 miles an hour, and trains of seven cars, under three minutes' headway, to run 25 miles an hour. Each car will seat 50 passengers. I have also proposed to the New York and Brooklyn Bridge Trustees to equip a railway service connecting the City Hall in New York with the City Hall in Brooklyn in the interest of all the surface roads in both cities, thus converting the bridge into a connecting link for all purposes of transit. This can be done without making any change upon the structure or entailing any considerable expense."

We hear that the proposed meeting, alluded to above, was held, and that a preliminary exchange of views took place. Meetings of the several companies will be held to consider the question, and their conclusions submitted to an adjourned meeting to be held on Tuesday, Nov. 25.

Some Old Morse Letters.

Great interest always attaches to the steps by which the great inventions of the world have been carried to practicability and perfection, and every additional document is welcomed if it throw light on the feelings and actions of the inventor at the critical stages of his work. We give below a few letters from the hand of Prof. Morse, recently brought to light, and our readers will at once recognize in them a valuable contribution to the history of the telegraph. We give them in their chronological order. The first two are in the possession of Mr. Wm. Hadden, the electrician, of 30 Broad street, and have recently been facsimiled by him. The letter of April 13, 1838, is particularly interesting as showing the record of the first telegraph register ever made, the same as was exhibited before the Franklin Institute, at Philadelphia, in the early part of the year 1838. The other letter, to Mr. Alfred Vail, is important on account of the reference to Prof. Henry's co-operation, a matter in respect to which Prof. Morse's statements will be well remembered.

NEW YORK, April 13th, 1838.

Hon. F. O. J. Smith.

DR. SIR—I have just returned from Morristown, and found that Mr. Vail had nearly completed the apparatus, and in a very compact and convenient manner for travelling.

Mr. Vail had completed a straight postrule on a plan of his own, which operates exceedingly well, so that for exhibition abroad, we shall not need another, and there is not time to construct a circular postrule before we sail. The register acts well. The pen which is so divided as to make 4 copies of the intelligence at the same moment, is also newly invented; you have a specimen of the first trial of the machinery, below, you have the alphabet, so I shall let you decipher it, only remarking that the dots are a little elongated and have, (as well as the dashes,) a blunt beginning which will not belong to the sign when properly adjusted. You will also take care in reading the signs to observe the difference (4 kinds) of spaces or intervals. I thank you for the copy of the bill, and am looking with anxiety for the report and the action in Congress upon it. You have doubtless received my letter in answer to yours respecting sailing the 10th of May. Please send anything interesting on the subject of the Telegraph that occurs in the house and believe me as ever truly

Yr friend & ob. servt.

SAM. F. B. MORSE.

(At the foot are the characters.)

The following is the letter to Mr. Alfred Vail:

NEW YORK, May 14, 1839.

MY DEAR SIR: There seems to be a fatality attending my attempts to see you or your brother when you visit the city. When your brother George appointed an hour to see me at my brother's office, I was told by some mistake that the hour was 11 instead of 9, which latter, it seems, was the true hour. I was punctually at the office at 11, but unfortunately found myself at the wrong time. I went to the Pacific Hotel and railroad office, and walked Broadway for two or three hours in hopes to meet him, but in vain. When you were here some days ago and called at the office you did not leave word where I could find you, but I went to the Pacific Hotel and inquired for you, without success. When either of you come to town, if you will leave word at the *Observer* office where you can be found, I will call on you.

The separation of the proprietors of the telegraph, so that no consultation can be had, is, I fear, doing an injury o us all. I cannot move a step without such consultation. The Russian engagement is doubly defeated for this season. It must be delayed now for a year. I was dreading the arrival of advices at the time promised (10th of May), for I should have been unable to meet the engagement if they had arrived, not having been seconded by the other proprietors (to whom I impute no blame, however, their circumstances doubtless having made it out of their power to help matters forward). This would have been exceedingly unfortunate, and even disastrous, probably, to the whole concern. Now, however, the delay on the part of Russia gives me an opportunity of deferring the arrangement until another year, thus giving us all time to make everything complete for that enterprise—one certainly of the deepest interest to us, and which we ought to apply ourselves to and expedite with all our energies.

I go to-morrow to Princeton on a visit to Prof. Henry, to have some conversation with him on particular points relating to the telegraph. There are some necessary to settle by experiment, and I have every encouragement from him as to the result.

Give my respects to all. I would visit you if I could, and will if I can. In the meantime, believe me, as ever, truly your friend, SAM. F. B. MORSE.

The other letters given below were addressed to the late Judge William W. Boardman, of New Haven, who, in 1842, was a member of Congress, and who, as the especial friend of Prof. Morse, did a great deal to advance the interests of the electrician and secure legislative recognition for a project which at that time was generally accounted visionary. This was the first letter, extending thanks for favors and reciting the inventor's ambitions:

NEW YORK, March 7, 1842.

MY DEAR SIR: I intended long since to have written you and thanked you for your kind attention in relation to my telegraph and for your resolution of inquiry. Please now accept my thanks. I have been constantly occupied this Winter in simplifying some parts of the mechanism and had hoped to have everything complete to show it, in Washington this session. I still may be able, but dare make no promise, knowing full well from experience the baffling and protracting nature of invention. My instrument is much more complete than it has ever been, and if in its ruder state it created so much interest, I feel confident of a greater when the perfect instrument is seen. I have just received a letter from Prof. Henry, of Princeton, which I copy for your perusal, and with a view of having it handed in to the committee. I need not say to you that Prof. Henry has a higher character as a philosopher and a discoverer in the department of electricity and electro-magnetism than any man in our country, and there is no man of the present age who stands higher in Europe in this particular department. You may recollect it was Prof. Henry who first successfully caused the magnet to hold suspended 2,000 pounds, and invented the first magnetic engine. With regard to the resolution of inquiry before the Committee of Commerce, may I ask the favor of you to have them suspend action upon it until I can show the telegraph in Washington, unless they are disposed to report the bill reported by the former committee. If they are ready to do this without seeing the operation of the instrument, very well. I shall then be able to show them a more extended application of its power the next session. But if they are not ready and should report it inexpedient, it might injure my operations next session. The following is the copy of Prof. Henry's letter:

PRINCETON COLLEGE, Feb. 24, 1842.

Prof. Morse:

DEAR SIR—I am pleased to learn that you have again petitioned Congress in reference to your telegraph, and I most sincerely hope that you will succeed in convincing our Representatives of the importance of the invention. In this, however, you may perhaps find some difficulty, since, in the minds of many, the electro-magnetic telegraph is associated with the various chemical projects constantly presented to the public, and particularly with the schemes so popular a year or two ago for the application of electricity as a moving power in the arts. I have asserted from the first that all attempts of this kind are premature and made without a proper knowledge of scientific principles. The case is, however, entirely different in regard to the electro-magnetic telegraph. Science is now fully ripe for this application, and I have not the least doubt, if proper means be afforded, of the perfect success of the invention. The idea of transmitting intelligence to a distance by means of electrical action has been suggested by various persons, from the time of Franklin to the present; but until within the last few years, or since the principal discoveries in electro-magnetism, all attempts to reduce it to practice were necessarily unsuccessful. The mere suggestion, however, of a scheme of this kind is a matter for which little credit can be claimed, since it is one which would naturally arise in the mind of almost any person familiar with the phenomena of electricity, but the bringing it forward at the proper moment when the developments of science are able to furnish the means of certain success and the devising a plan for carrying it into practical operation are the grounds of a just claim to scientific reputation as well as to public patronage. About the same time with yourself Prof. Wheatstone, of London, and Dr. Steinheil, of Munich, Germany, proposed plans of the electro-magnetic telegraph, but these differ as much from yours as the nature of the common principle could well permit, and unless some essential improvements have lately been made in these European plans I should prefer the one invented by yourself. With my best wishes for your success, I remain, with much esteem, yours truly,

JOSEPH HENRY.

Thus you will perceive that Prof. Henry accords precisely in opinion with the committee of the French Government which examined both Wheatstone's and Steinheil's in connection with mine, and gave the preference to the American. I cannot doubt, when the subject is fully understood, that our Government will appreciate the importance of this invention. The mind may speculate very freely on the revolution which the instantaneous interchange of thought from one part of the country (I may say of the world) to another has effected, and although to one who is ignorant of the nature of the invention these speculations may seem the vagaries of a prurient imagination, the reality will still outstrip his conceptions. I ask my Government for aid in giving this invention to the world and demonstrating its American origin and perfection. Will they do it? If thought advisable in the existing state of the finances of the country to appropriate a less sum than is asked for by the bill formerly reported, a less sum, say $15,000 or $20,000, would give the invention a sufficiently extensive trial on which to found future legislative action. I leave the subject to the wisdom of Congress. I have written on the subject (some weeks since) to several friends in Washington, to whom, if you are so disposed, please show this letter—to Mr. Barnard, Mr. Winthrop, Mr. Cushing, Mr. Granger, and any others, at your convenience and pleasure. With sincere esteem, your friend and servant, SAMUEL F. B. MORSE.

The Hon. WILLIAM W. BOARDMAN.

Nine months later the following letter was written by the devoted inventor, evidently in a confidently hopeful mood:

WASHINGTON, Tuesday, Dec. 14, 1842.

MY DEAR SIR: My telegraph is in fine order this morning and established between the Committee of Commerce of the House and the Naval Committee of the Senate. I shall be happy to show its operation to any of the gentlemen of the House whenever it suits their convenience. Truly, with respect, your friend and servant,

SAM. F. B. MORSE.

The Introduction of New Units.

Discussing the unit suggested for adoption at the recent National Conference of Electricians, *Mechanics* says:

"The proposition made by Mr. W. H. Preece, at the recent meeting of the British Association, to change the electrical horse-power from 746 watts to 1,000, and the number 33,000 to 44,236 foot-pounds, so as to preserve the corelation between the electrical and the mechanical horse-power, has very properly been severely criticised, and it is extremely doubtful whether Mr. Preece's desire to thus establish a new unit will be gratified. Although the adoption of the proposed change would, perhaps, in some respects be convenient for electricians, it is evident that the confusion arising from an excessive multiplication of new units is a constant source of annoyance, and even a superficial investigation would have shown Mr. Preece that the deep-rooted prejudice against the introduction of such units, unless in imperative demand, is not unfounded. Assuming that the substitution of 1,000 watts for 746 as an electrical horse-power would really prove as desirable as claimed, it is not at all clear why the convenience of engineers in general should be sacrificed for the convenience of those more directly interested in the study of electricity, and hence the suggestion made a short time ago that the new unit be called a preece instead of a horse-power. This, of course, would eliminate one of the objectionable features of the proposition, but still the fact remains that we would have another addition to the already long list of existing units—a circumstance which in itself is by no means desirable, and which, we trust, will not and ought not to meet with approval.

Edson's Standard Pressure Gauges, Edson's Speed and Pressure Recording and Alarm Gauges.

One of the most attractive features at the Philadelphia Exhibition was the Edison "Jumbo" dynamo electric machine, and the most prominent part of that portion of the exhibit was the Edson Speed Recording and Alarm Gauge. Some people seeing the gauge there and noting the name, at once attributed the ingenious invention to the great electrician. The merit of it belongs, however, to Mr. M. B. Edson, of this city, whose ingenuity has been well applied for many years, and whose special apparatus is made and sold by the Edson Recording and Alarm Gauge Co., of 91 Liberty street, New York. This admirable device assumes the onerous task of watching over the due discharge of the responsible functions performed by the steam in the boiler, the dynamo engine and the engineer and fireman. In short, it indicates pressures of steam, air, water, etc., records every change, and its regular automatic working is one of the best safeguards that an installation or plant can be provided with where it is needful to know the pressure and speed at all times. The high esteem in which the gauges are held is exemplified by the fact that they have been used by the Board of Examiners at the Philadelphia Electrical Exhibition by the authority of the Franklin Institute, in making tests, and which resulted in their adoption as the only correct Indicating and Recording Gauges for fluids and liquids under pressure. The recently extended uses of electricity renders a recorder of speed an absolute necesity. The invention, patented 1881, was not completed any too soon for these purposes.

A Mutineer against Motoneer.

To the Editor of The Electrical World:

SIR: I observe in your issue of Nov. 15 a communication signed Geo. W. Mansfield, and entitled (I presume by the editorial hand) 'Shall It be Motoneer?"

In the name of the English language, Mr. Editor, I trust that the question is editorially put. It certainly would seem that the coiners of new words have this time overstepped the line, and given us a monstrous hybrid which has not a single redeeming feature or a single excuse for life.

"Cablegram" was bad enough, for even in the case of a telegram received from beyond the sea, there is no need of a new word or of any distinguishing mark between a telegram received in New York from London—which passes over a land line from London to Holyhead, through a submarine cable to Dublin, takes a land line again across Ireland, a submarine wire across the Atlantic, a land line across Newfoundland, a third submarine cable to the mainland, and again a land line to New York—and a telegram received in New York from San Francisco, which traverses overhead lines the greater part of the way, but passes also some half dozen river and bay cables en route. What possible change can there be in the nature of a message transmitted electrically by reason of the greater or less proportion of submarine cable to land line?

"Electrolier" is another monstrosity which the word-making fatuity of the age has brought into use. It is probably useless to attempt to check these barbaric innovations, but it is nevertheless the duty of the lovers of pure language to protest. Those who brought "electrolier" into the world will say, Why not electrolier as well as chandelier? Simply because chandelier is a legitimate derivation from the French word "*chandelle*," and electrolier is like Melchizedek, *i. e.*, "without father, without mother, without descent."

But, "to return to our moutons," "motoneer" is the worst specimen yet launched upon a long-suffering public.

Referring to "Webster" I find that "motor" is defined as follows: "Motor." n. (Latin, from *movere, motum*, to move). "One who, or that which imparts motion; a source or originator of mechanical power; a moving power, as water, steam, animal strength, etc."

"Engine," by the same authority, is derived from *Lat.—ingenium*, and is defined (*Mech.*), "A compound machine or mechanical contrivance by which any physical power is applied to produce a given physical effect."

Further—It takes in composition other words designating the source of power as *steam engine, air engine, caloric engine, electro magnetic engine, gas engine*, etc.

It thus appears that, strictly speaking, the term "*motor*" itself is wrongly applied to the engine by which the electric energy is utilized, and should be only applied to the electric energy when so employed; the intermediate mechanism itself being an "engine."

We may, however, concede the term "motor," as being a comparatively unimportant mis-statement, but all persons interested in electrical literature should certainly remain "mutineers" with respect to "motoneer."

It is clear that if the attendant of an electric engine is to be called a "motoneer," the attendants of gas engines, steam engines, air engines, etc., are entitled to the same distinction.

I had intended, for the benefit of your readers, to refer once more to Webster for the derivation and definition of the word "Daft," but on second thoughts I will content myself with stating that they will have no trouble in finding it themselves; and with quoting the line from "Scott," which is there given as an illustration: "Let us think no more of this '*daft*' business."

BOSTON, Mass., Nov. 18. THOS. D. LOCKWOOD.

Storage Batteries.

Mr. Lodge thus speaks of storage batteries in a recent article published in England:

"The age of plates is a point of vital interest, though but little is known of the possibilities in this direction at present. A year may be regarded as a fair average age at the present time; but this is a low rather than a high estimate. Thick plates are found to last far longer than thin, which is only natural when it is remembered that the wearing out is due to corrosion, that corrosion proceeds mainly from the surface inwards, and that the internal portions of a thick plate are to a great extent protected by the mass of superincumbent material. If it can be shown, as we understand it can, (1) that the cost of materials is far more than the cost of manufacture; (2) that the worn-out material has a market value not incomparably less than the original; and (3) that the frequency with which plates have to be renewed is not such as to cause much inconvenience; then we hold that the first stage of the durability difficulty has been overcome. Much more may be hoped for in this direction as experience increases, and it is not extravagant to hope that a well-ribbed, properly clamped and fairly-treated thick plate may last as long as five years before it becomes disintegrated." Another point of great interest, and one too often overlooked, is thus stated: "It is not to be supposed that one type of cell will answer every possible demand. A dynamo, to be highly efficient, must have a large, massive field magnet, but in some places bulk and weight are fatal objections, and in these places smaller and more compact dynamos may be more suitable; something, however, must be given up to secure the required lightness and compactness—some sort of compromise must be effected. Just so with cells. We can point out what is theoretically the best form, and this form may, for large stationary electric light or power installation, be actually the most suitable; but we may also see that for boats, for tram cars, and for fish torpedoes some very different and far more compact form may be quite essential." After a similar but short discussion of the negative plate the article concludes: "The subject of the electrical storage of energy is really one of national importance; it is comparatively a small matter whether this or that form of storage, or this or that company of manufacturers, succeeds in bringing out the permanent form. It sometimes unfortunately happens that enterprising pioneers only clear the way, and retire just in time for other men to come in and reap the fruits of their labors. So much capital and so much labor have been already expended in the effort to bring storage batteries to perfection, so great progress has been made, and so apparently small are the steps which yet remain to be accomplished, that we may surely fairly hope that some of the original believers in their great, and as it seems to us inevitable, future may yet live to see their faith justified and their patience rewarded, and may even taste some of that so-called 'substantial' reward without the hope of which great commercial enterprises would never be undertaken, and modern civilization would have scarcely yet begun."

An Electrical Chart.

Dr. Brubaker, of Charleston, Ill., has recently copyrighted a chart of "Electricity Made Plain." Its dimensions are only about 3 × 2 ft., but in that small space is contained an amount of knowledge, which, if studied and remembered, would enable any person, previously ignorant of electrical science, to pass himself off as a graduate of an electrical college, provided he had sufficient talent to know how to make the best use of the information thus obtained. It is not only a useful and easy method of acquiring a superficial knowledge, but it cannot fail to become generally useful to young electricians as a reference chart in occasionally refreshing the memory.

THE TELEGRAPH.

A MARRIAGE BY TELEGRAPH ANNULLED.—The divorce suit of Sarah Orten Welch against Thomas Welch came up before Judge Taylor at Indianapolis, Ind., on Nov. 8. This is the case which has had such a wide notoriety by newspaper publications. The woman claims that while a resident of Pittsburgh in June, 1883, she answered a "personal" advertisement in the Cincinnati *Enquirer*, as a result of which a correspondence sprang up between her and Welch, and they were married, the ceremony being performed by telegraph. When she went to meet him she found that he was a colored man. In court the fact that he was of a negro descent was established, although he insisted that his father was a Spaniard and his mother a Frenchwoman. The marriage was declared void by the court. Welch is a barber.

COSTLY POLES.—When the Baltimore & Ohio Telegraph Company ran its line through Taunton, Mass., certain citizens objected to poles being placed in front of their premises, and petitioned the company for compensation for damages. The Board of Aldermen were selected as the referee, and, after several hearings, the matter was finally decided by the following awards: Mrs. Anna M. Fuller, $100; Susan H. Hathaway, $100; Francis E. Hood et al., $100; J. F. Montgomery, $100; Margaret Bearse, $50; Angelini Wilbur and J. W. Stavers, $50. The whole matter opens questions which may lead to endless litigation if those having poles within 40 feet of their premises are disposed to ask damages.

CHICAGO BUCKET SHOPS.—In the case of the "Chicago Marine and Grain Stock Exchange" versus the Western Union Telegraph Co. and the Chicago Board of Trade, to restrain them from cutting off its market reports, Judge Blodgett, of the United States Circuit Court, held that the Board of Trade had exclusive right to their own quotations, and could do as they saw fit with them, by allowing or refusing any particular person the privileges of the quotations. The court, therefore, refused to sustain the motion to dissolve the injunction. Although the complainants appealed from this decision to another court, and secured a temporary injunction, it is thought that the last of those pestilent and demoralizing nuisances called "bucket shops" is virtually wiped out.

THE TELEPHONE.

TELEPHONE LINES IN SCOTLAND.—The longest talking line in North Britain is between Edinburgh and Glasgow, a distance of fifty miles; but conversations have been held repeatedly between Greenock and Edinburgh, *via* Glasgow, some seventy-eight miles, and the canny Scotts think it wonderful.

TALMAGE, THE TABERNACLE AND THE TELEPHONE.—It is announced that Mr. Talmage is about to introduce the telephone into the Brooklyn Tabernacle, for the benefit of those who are unable to get out to church. Also that when the great Fair opens in the Tabernacle next week, a telephone is to be fastened to the keyboard of the organ and connected through the exchange with the principal stores so that every requirement may be filled without the delay attendant upon messenger service.

TELEPHONIC AND SIGNAL STATION COMBINED.—In the shipbuilding yard of Messrs. Denny Brothers, at Dumbarton, Scotland, there is a telephonic exchange which enables about 30 departments to hold instant communication with any other. A mast 90 ft. high is erected in the centre of the yard. A member of the firm desiring the attendance of another partner, goes to the nearest station, communicates with the exchange, gets the mast-station, and a signal representing the party wanted is run up. The official sees the flag bearing his number, goes to nearest station and connects with the person calling him.

DANCING TELEPHONISTS.—The Boston *Herald* of the 16th says: The large building corner of Franklin and Pearl streets was flooded with light last evening, the occasion being a reception of the operators of the New England Telephone and Telegraph Company by the management. Every room in the building was lighted, and most of them used for the accommodation of the guests. The third floor was used as a supper room, while the fourth was utilized for dancing, and both were handsomely decorated. The large hall was filled by a merry party. Each lady was supplied with a large bouquet, while most of the gentlemen had rosebuds in their buttonholes. Carter's orchestra furnished music. The floor was under the direction of Prof. G. A. Gustin, with G. B. Appleton and Arnot Quinby as aids.

THE ELECTRIC LIGHT.

ELECTRIC-LIGHT SIGNALING.—To use an Edison lamp, suspended from a small captive balloon, as a signal light at night, is a proposition advanced by Capt. Kostrovich of the Russian navy. A lamp thus elevated could be lighted and extinguished at will through the connecting wires, and the apparatus could be used for any of the codes in vogue. The experiment will doubtless be tried.

"IT'S AN ILL WIND, ETC."—The police commissioners of Linlithgow, Scotland, became brave enough lately to rebel against the rule of the gas company in that town and the cost of public lighting. The controversy developed so unpleasantly that the leading men of the place called in electric lighting engineers from Glasgow and gas is to be superseded by electric lights.

THE LIGHT IN PARIS.—The large publishing firm of Hachette et Cie, of Paris, have ordered 350 Edison lamps to complete the illumination by electric lights of their entire Paris establishment. For two years past in their folding and binding departments incandescent lamps have been used, and the satisfaction given by these has resulted in the increased employment of the system.

FOR SAFETY AND ECONOMY.—The Anglo-American Brush Electric Light have introduced electricity as an illuminant into the very extensive establishment of Messrs. Andrew Usher & Co., distillers, of Edinburgh. A saving of 33 per cent. in cost and safety against fire are the principal reasons for the adoption of electric lighting, even when gas would furnish sufficient illumination.

THE ANTWERP UNIVERSAL EXHIBITION.—The Executive Committee having decided to illuminate by electricity the buildings and grounds of the coming Universal Exhibition, at Antwerp (from June 1st to Oct. 31st, 1885), invited proposals from all electric light companies, and requested also exhibits of every system. Proposals for the contract business were to have been sent in before the end of last week.

ADVANCING IN AUSTRIA.—The lighting by electricity of Temesvar, Austria, was accomplished on the 27th of last month, the lamps burning with full power and gas being done away with. On Saturday, Nov. 1, there was a grand illumination exclusively by electric lights. From the 15th of the present month until December 1, the official tests will continue, and if these are satisfactory a contract will be signed with the company—the English International.

BRIGHT BUSINESS PROSPECTS.—The Maxim-Weston Electric Co., Limited, of London, in their late half-yearly circular to shareholders state that the profits on their summer business will cover the expenses of the entire year. It is said that this company purchased with their patents the right to all improvements for a period of years, a most advantageous arrangement, and they now claim that their arc and incandescent systems, invented by Mr. Weston, are the most efficient, durable and complete extant. Between 300 and 400 of their incandescent lamps have been kept running at Covent Garden Theatre for 450 hours without one renewal.

LIGHTING THE SHIP AT SEA AND IN PORT.—The details of lighting by electricity the new steamship "Olympo," built in Glasgow, Scotland, are most interesting to the electrician; an especial and novel feature being the introduction into that line of lighting of storage batteries. There are 45 cells which can be charged while the dynamo is running and lighting lamps, and this accumulated energy may be used for illuminating any portion of the vessel when she is in port and steam cannot be obtained. The steamer's installation consists of 320 incandescent lamps of 20 candle-power, divided into six circuits, each of which is controlled by a switch in the engine room, and every state room is provided with a lamp having a separate switch under control of the occupant. Over each gangway, suspended by strong but elegant brass swinging brackets, is a lantern containing a group of six incandescent lamps of 20 candle-power. These lanterns can be shipped or unshipped at pleasure. The engine for driving the dynamo is a J. and H. Gwynne's "Invincible," and its speed is controlled by an Auldo reducing valve placed close to the switch-board. The dynamo is one of the Elphinstone Vincent type, capable of lighting 400 lamps, running at 900 revolutions per minute, with an electromotive force of 90 volts. The entire installation is reported as a splendid success.

APPLICATIONS OF POWER.

THE CREIL EXPERIMENTS.—The *Bulletin* of the Cie Internationale des Telephones states that 400,000f. out of the 500,000f. at its disposal, will be sufficient for the committee, sitting at Paris, to conduct the trials of M. Marcel Deprez's system of transmitting electric current. The experiments will carry out, for several weeks together, the working of a central station for the generation of current and its transmission to a distance under such conditions as would be met in actual practice; the while analyzing every detail and following every change and influence until the true value of the invention and its application to industrial arts are finally determined.

MISCELLANEOUS NOTES.

PROF. HENRY'S LIBRARY.—The library of the late Prof. Henry, of Washington, has been purchased from his heirs by Prof. Graham Bell. It contains about 2,000 volumes, at least one-third of which treat of electrical science, and many of these bear marginal notes in the handwriting of Prof. Henry. One of the terms of the sale was that the library should be kept intact.

A "WALK-OVER."—As the secondary generators of Messrs. Gaulard and Gibbs had no competitors at the Turin Exhibition, they were awarded the 10,000f. ($2,000) prize offered for the best process presented for the distribution of electrical energy at a distance. The jurors were called upon only to regard the question in its scientific aspect, without taking into consideration the cost of the current transmitted.

A NEW CAOUTCHOUC.—The attention of the government of British India has been directed, it is reported, to a tree, native of Southern India, from which large quantities of caoutchouc can be obtained, not from tapping by piercing the bark, as is done with the South American tree, but by breaking the boughs and drawing it out in filaments. The tree yielding this new caoutchouc is the "Teichmig" of the Chinese, or Prameria glandulifera of botanists, and if the fibre obtained from it is found to possess the same insulating properties as the article now in use it will be a most timely and welcome discovery.

AN ELECTRIC SAFETY SIGNAL.—By means of a wire connecting an electrical machine placed in the telegraph office of a railway station, and connected with two bells on a pole at swing bridges or other points of danger, a Swedish engineer has invented an arrangement for preventing railway accidents. A spring disc, seven inches in diameter, is fitted to the engine; this disc makes contact with the pole as the train passes, and the bells are thereby made to give warning to the driver of an approaching train or one following, and to indicate at the nearest station the passage of the train.

ELECTRICAL MINTING.—In all minting operations a certain percentage of the coinage is found either over or under weight. The first kind is filed away to proper standard and the "lights" are remelted. In both cases loss of gold is the result. To reduce the weight without interfering with the sharpness of the impression, or to add the small number of grains required in case of either imperfection, the chemist of the London Mint, W. F. Chandler Roberts, has employed an electrical current in connection with suitable acid baths, and thereby he reduces the heavy coins, being able to calculate exactly the time required to dissolve all superfluous metal; and he has also provided in like manner for the galvanic deposit of all gold wanting on "lights." In both cases provision is made for automatically breaking the circuit when the precise weight is attained. This method has been used to great advantage in the mints of British India, but the law which rules the London institution imperatively directs that every piece, too light or too heavy, goes back to the melting pot.

AN ARTIFICIAL AURORA.—In the experiments of Mr. Selim Lemstron, on the artificial production of the aurora, in Northern Europe, a wire was stretched on poles on the top of the mountain, and furnished at every foot or two with brass points. This wire was several miles in length, and was carried over the top of the hill in the form of a spiral. To prevent so much as possible the creeping of electricity over their surfaces, the poles were supplied with sulphuric acid insulators. Between 500 and 1,000 feet on a lower level from the insulated system of points a wire was run to the ground connection, as no current would have been observed if such connection had been made on the same level, but in each differences of level, even when only thirty feet, a current was always observed from the higher point to the lower. By the aid of the spectroscope, which would show the peculiar spectrum of auroral light, the existence of the streamer could be often proved, but to the naked eye the luminous effects were only visible when there was a marked display of northern lights.

THE FREQUENCY OF STORMS.—In April, 1882, the imperial telegraph office of Germany inaugurated a system of observing and recording storms over the entire area of the empire, and since that date regular reports have been transmitted from all provincial offices to the headquarters of the department in Berlin. The *Elektrotechnische Zeitschrift*, which gives a summary of the results obtained during the first two years since the establishment of the system, states that during the first 12 months the number of days on which there were one or more storms in any part of Germany was 129, while in the following 12 months storms occurred on 124 days. The total number of storms from April, 1882, to April, 1883, was 2,684, and in the following 12 months 2,064. The season when storms were of the greatest frequency was in both years during the hottest months—namely, June, July, and August. In the east and north storms were less frequent than in the west of the empire, and it was in the southwest that they occurred most frequently of all. Storms occurred under almost all conditions of the atmosphere, but they were most numerous when the barometer showed a pressure of 750 to 760 millimetres. From the tables recording the hours when storms occurred, it appears they are most frequent not only in the hottest season of the year, but also in the hottest period of the day.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange, and elsewhere are as follows:

TELEGRAPH.—American Cable, a 53; Bankers & Merchants', b 2, a 4; Mutual Union, b 13, a 14½; Postal stock, a 4; Postal sixes, b 29, a 32; Western Union, b 60½, a 60⅝.

TELEPHONE.—American Bell, b 190, a 191; Erie, b 18¾; Mexican, b 1¼; New England, b 31.

ELECTRIC LIGHT.—Edison, b 40, a 75.

BUSINESS NOTICES.

CUMMER ENGINES.—The Cummer Engine Company report great activity in their business, and if everybody else were as active there would be no doubt that the long spell of general depression had come to an end. We note among their last batch of shipments two engines of 67 h. p. each for the Citizens' Electric Light Company of Akron, O.

AMERICAN ELECTRIC CONSTRUCTION AND SUPPLY CO.—This company, of 125 North Seventh street, Philadelphia, gives notice that Mr. Harry H. Levett, late Superintendent of the United States Electric Light Company of Pennsylvania, member of committee of the International Electrical Exhibition, and also of the Electrical Section of the Franklin Institute, a thoroughly practical and experienced electrician, having purchased an interest in the company, has been appointed superintendent in place of Mr. H. G. Rees, and will take charge of the electrical and repair departments. It is also announced that the compauy has severed business relationship with Messrs. H. G. Rees and Ernest Kitson.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by EDWARD P. THOMPSON, M. E., Electrical Expert, 9 Murray Street, New York.

PATENTS DATED NOV. 4, 1884.

Automatic Tension Line Holder; M. Randolph, New York, N. Y., Assignor to W. W. Gage, Trustee, of same place..... 307,589

It is for mechanical telephones, said holder consisting of two fluted cylinders or spools mounted on the bifurcated end of a revolving axle, by which they are revolved around the axis of said axle, so as to wind the wire upon the said spools, and thereby tighten it as required, the wire being placed between the said spools, and thereby tightened by said spools as they rotate about the axial centre.

Car Brake; H. Flad, St. Louis, Mo., Assignor to the Electro-Magnetic Brake Co., of E. St. Louis, Ill..... 307,534

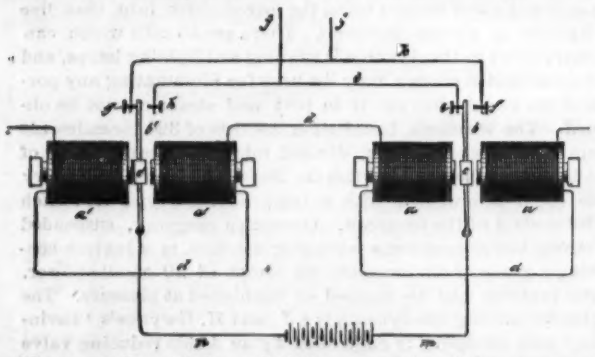
Consists of the combination, with the direct brake-operating air-chamber and devices connecting it with the brakes of the valve-chamber containing the tubular valve, the reservoir connected with said valve-chamber and main pipe, the electro-magnet and suitable connections for operating said tubular valve for opening communication between the reservoir and the brake-operating chamber by cutting off communication between said chamber and the external air and vice versa.

Car Brake; H. Flad, St. Louis, Mo., Assignor to Electro-Magnetic Brake Co., E. St. Louis, Ill..... 307,535

It might be considered objectionable to use the wheels and rails as a portion of the electric circuit, a complete metallic circuit comprised within the main air-pipe and couplings is therefore provided.

Electro-Magnetic Pole Changer; S. E. Smith, New York, Assignor to the Gold & Stock Telegraph Co., of same place..... 307,498

If a battery, *l*, be connected by wires *m n* to levers *b b'*, respectively, and one end of a circuit, *j*, be connected by a wire *k*,



with screws *f g*, and the end of the same circuit be connected with screws *e h* by a wire, *i*, reversed currents through circuit *d* will cause levers *b b'* to alternately connect with opposite ends of circuit *j*, and thus reverse the current of battery *l* over the circuit last named.

Detonating and Visual Signal for Railways; E. W. Applegate, Washington, D. C..... 307,517

Consists of a revolving set of arms, which may be caused to turn out and place the torpedoes, which they hold upon the rail of a railroad-track when there is danger ahead, and may be, and are, withdrawn when the obstruction is removed and safety prevails. One of the arms, being thrust out to place the torpedo, knocks down a door which displays a visual signal.

Electric Arc Lamp; J. M. Pendleton, New York, N. Y., Assignor to the Equitable Electric Co., of same place..... 307,584

Consists of a pivoted frame or lever, a carbon-holding rod passing vertically through it on one side of its axis, an annular clamp having two tail-pieces or extensions, by one of which it is suspended from the lever on one side of its axis by means of a link, and a rod having two adjustable stops suspended from the lever on the other side of its axis, the said stops acting on and controlling the free tail-piece of the clamp, one to free the rod and the other to determine the distance it is raised.

Electric Arc Lamp; R. J. Sheehy, New York, N. Y. 307,683

Consists of a central vertical shaft or spindle, a series of radial arms affixed thereto, a series of positive electrodes respectively carried by said radial arms, a series of clamping mechanisms each carried by one of said arms, and stationary electro-magnets for actuating said clamping mechanisms successively.

Electric Battery Telephone; T. D. Lockwood, Malden, Mass..... 307,478

The walls of the telephone contain a hermetically sealed galvanic cell. A spring contact closes the circuit only when the hand is clasped upon the handle.

Electric Call; D. H. Rice, Lowell, Mass., Assignor to Currier Telephone Bell Co., of Mass..... 307,494

The combination of a striker and its magnet adapted to be operated by a broken or undulatory current sent from a distant station, and an automatic circuit-breaker operated by the electric current.

Electrical Circuit Protector; E. T. Gilliland, Boston, Mass., Assignor to the American Bell Telephone Co..... 307,639

Consists of a strip of metal fusible at a comparatively low point and fastened to colored insulating strip which shows by contrast when the metallic strip is fused.

Induction Coil; J. Allen, Washington, D. C..... 307,699

Consists in the application of an iron cylinder placed around the outside of the secondary coil.

Railway Air-Brake; H. Flad, St. Louis, Mo., Assignor to Electro-Magnetic Brake Co., East St. Louis, Ill..... 307,536

Consists of an air-brake pipe having a cut-off cock arranged therein, of the by-pass or loop pipe having its ends connected with the main pipe on opposite sides of the cock, and the electric conducting-wire arranged through the main pipe and the by-pass pipe, and sealed in the latter.

Regulator for Dynamo-Electric Machines; R. J. Sheehy, New York, N. Y..... 307,684

Consists of a generating-armature, its shaft, a motor-armature mounted upon said shaft and tending under the influence of the generated current to revolve in a direction opposite to the direction in which said generating-armature revolves, and mechanical means for rotating said shaft.

Regulator for Systems of Electric Distribution; W. M. Thomas, Grand Rapids, Mich., Assignor of one-half to the Grand Rapids Electric Light and Power Co., of same place..... 307,690

Consists of a shunt-circuit placed around the coils of the field-magnet and accompanying the circuit in which the lamps or instruments are placed, and means for varying the resistance of the shunt as the instruments are thrown into or out of circuit for the purpose described.

Printing Telegraph; A. & E. Wieshing, Brooklyn, N. Y..... 307,696

Consists of two type-wheels and a printing-pad carried on a printing lever, of type-wheel-controlling electro-magnets, and a printing-pad-controlling electro-magnet, the latter being connected in a single line-wire circuit separate from that for the type-wheel-controlling magnets, and adapted to be operated by positive and negative currents of electricity.

Secondary Battery; A. S. Hickley, Montreal, Canada, Assignor by mesne assignments to the Electric Amalgam Co., of Maine..... 307,461

Mercury and carbon in small pieces are the electrodes separated by a horizontal grating. The invention is an improvement upon patentee's patent of Nov. 2, 1883.

Secondary Battery; A. S. Hickley, Montreal, Canada, and W. S. Hill, Boston, Mass; mesne Assignors to Electric Amalgam Co., of Maine..... 307,462

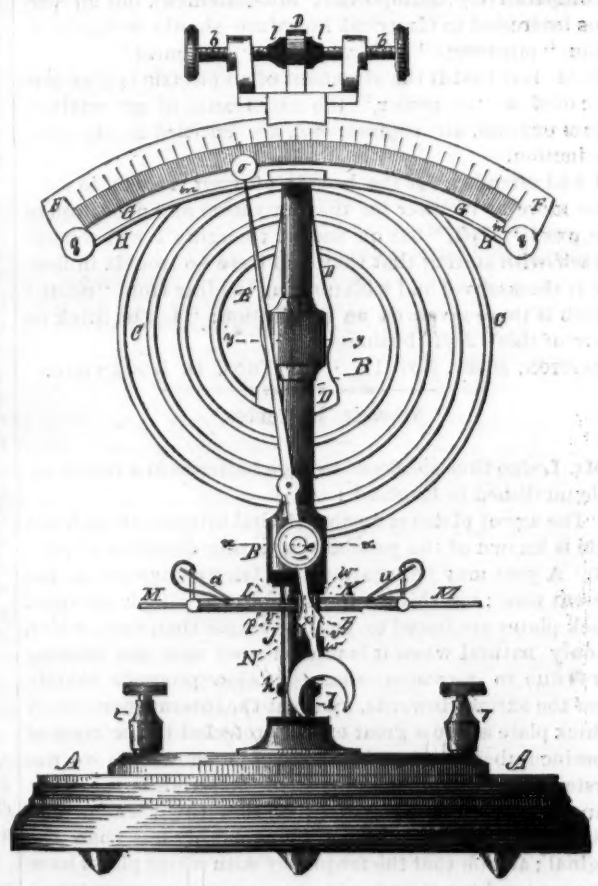
The features of the battery are a case in which are contained a series of vessels separated from each other by stools, each containing a body of mercury; a series of carbon-rods contained within the cell; a filling of broken carbon surrounding the mercury-receptacles and entering the spaces between them; and an electrolytic fluid composed of chloride of sodium.

Secondary Battery; A. S. Hickley, Montreal, Canada, mesne Assignor to Electric Amalgam Co., of Maine..... 307,463

Consists of combination of anodes of carbon and mercury electrodes and electrolyte of sodic chloride.

Electro-Magnetic Thermoscope; H. J. Haight, New York, N. Y..... 307,543

A ridge, *G*, is formed on the scale, and it is provided with a series of sharp projections or outwardly-projecting teeth, *m m*, and a very thin flexible finger is attached to the index, and adapted to have its inner end just lightly touch the extremities of the teeth on the contact-strip *G* when the index moves in front



of them. Consists also of a commutating-slide, *M*, provided with circuit-closing contact-rods *v v*, respectively in electric connection with temperature-increasing and temperature-decreasing transmitting-wires, and a temperature-determining hand or index, *E*, actuated by a thermostatic coil and provided with a contact-pin, *N*, located between the said circuit-closing rods.

Speaking Telephone Transmitter; T. J. Perrin, New York, N. Y., Assignor to the Nat. Improved Tel. Co., of same place..... 307,728

Consists of a lever or electrode-support which maintains the electrodes in contact, an electro-magnet the helix of which is included in a primary circuit, and a spring or yielding device which bears on said lever and tends to prevent the lever from leaving the field of its magnet.